TM 5-4120-355-14

TECHNICAL MANUAL

# OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

## AIR CONDITIONER, VERTICAL COMPACT, 6,000 BTU 115 VOLTS, SINGLE PHASE, 60 HERTZ (WEDJ MODEL VM 6000-115) NSN 4120-00-935-1608

## AIR CONDITIONER, VERTICAL COMPACT, 6,000 BTU 208 VOLTS, THREE PHASE, 400 HERTZ (WEDJ MODEL VM 6000-208) NSN 4120-00-935-1607

This copy is a reprint which includes current pages from Changes 1 and 2.

HEADQUARTERS, DEPARTMENT OF THE ARMY

30 JULY 1979

CHANGE
No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 28 January 1987

Operator, Organizational,
Direct Support and General Support
Maintenance Manual

AIR CONDITIONER, VERTICAL COMPACT,
6,000 BTU, 115 VOLT, SINGLE PHASE, 50/60 HERTZ
(WEDJ MODEL VM6000-115)
NSN 4120-00-935-1608
AIR CONDITIONER, VERTICAL COMPACT
6,000 BTU, 208 VOLT, THREE PHASE, 400 HERTZ
(WEDJ MODEL VM 6000-400)
NSN 4120-00-935-1607

TM 5-4120-355-14, 30 July 1979, is changed as follows:

1. Title is changed as fhown above.

2. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

| Remove pages | Insert pages |
|---|---|
| i and ii | i and ii |
| 1-3 through 1-6 | 1-3 through 1-6 |
| 1-7/1-8 | 1-7/1-8 |
| 2-1 and 2-2 | 2-1 and 2-2 |
| 4-5 and 4-6 | 4-5 and 4-6 |
| 4-21 and 4-22 | 4-21 and 4-22 |
| 6-1 and 6-2 | 6-1 and 6-2 |

3. Retain this sheet in front of manual for reference purposes.

**By Order of the Secretary of the Army:**

**JOHN A. WICKHAM, JR.**
***General, United States Army***
***Chief of Staff***

**Official:**

**R. L. DILWORTH**
***Brigadier General, United States Army***
***The Adjutant General***

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25A, Operator, Organizational, Direct Support and General Support Maintenance requirements for Air conditioner, Vertical Compact, 6000 BTU (VM-6000-115: 115V, 50/60HZ, 1PH; VM 6000-400: 208V, 400HZ, 3PH) (TM 5-4120-355 Series)

TM 5-4120-355-14
C 1

CHANGE NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 19 December 1986

Operator, Organizational, Direct Support
and General Support Maintenance Manual

AIR CONDITIONER, VERTICAL COMPACT, 6,000 BTU
115 VOLTS, SINGLE PHASE, 60 HERTZ
(WEDJ MODEL VM 6000-115)
NSN 4120-00-935-1608

AIR CONDITIONER, VERTICAL COMPACT, 6,000 BTU
208 VOLTS, THREE PHASE, 400 HERTZ
(WEDJ MODEL VM 6000 -208)
NSN 4120-00-935-1607

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| Remove pages | Insert pages |
|---|---|
| 3-1 and 3-2 | 3-1 and 3-2 |
| 4-7 through 4-10 | 4-7 through 4-10 |

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# WARNING

**High Voltage is used in the operation of this equipment.**

**DEATH ON CONTACT**

**Or severe injury may result if personnel fail to observe safety precautions. Always disconnect the air conditioner from the power source before performing maintenance on this equipment.**

**Do not operate the air conditioner without louvers, top covers, and guards in place and tightly secured.**

**WARNING**

**Refrigerant under pressure is used in the operation of this equipment.**

**DEATH**

**or severe injury may result if personnel fail to observe safety precautions. Never use a heating torch on any part that contains refrigerant - 22. Avoid bodily contact with liquid refrigerant and avoid inhaling refrigerant gas.**

TM 5-4120-355-14

TECHNICAL MANUAL

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON D.C. 30 July 1979

# OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL AIR CONDITIONER, VERTICAL COMPACT, 6,000 BTU, 115 VOLT, SINGLE PHASE, 50/60 HERTZ (WEDJ MODEL VM 6000-115) NSN 4120-00-935-1608 AIR CONDITIONER, VERTICAL COMPACT 6,000 BTU, 208 VOLT, THREE PHASE, 400 HERTZ (WEDJ MODEL VM 6000-400) NSN 4120-00-935-1607

## REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Troop Support Command, ATTN: AMSTR-MCTS, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished directly to you.

## TABLE OF CONTENTS

## LIST OF ILLUSTRATIONS

# CHAPTER I. INTRODUCTION

## Section I. General

1-1 Scope.

a. This manual describes the 6,000 BTU/HR, single phase, 60 hertz and 6,000 BTU/HR, three phase, 400 hertz air conditioners manufactured by WEDJ, Inc. It covers the installation, operation, organizational, direct, and general support maintenance of the equipment.

b. Appendix A contains a list of publications applicable to this manual.

c. Numbers in parenthesis following nomenclature callouts on illustrations indicate quantity. Numbers preceding nomenclature callouts indicate preferred maintenance sequence.

d. Equipment maintenance forms and procedures for their use are contained in TM 38-750, The Army Maintenance Management System (TAMMS).

e. EIR's will be prepared on DA Form 2407, Maintenance Request. Instructions for preparing EIR's are provided in TM 38-750, The Army Maintenance Management System. EIR's should be mailed directly to Commander, U.S.A. Support and Aviation Materiel Readiness Command, ATTN: DRSTS-MEM, 4300 Goodfellow Blvd., St. Louis, MO 63120.

1-2. Record and Report Forms.

a. DA Form 2258 (Depreservation Guide of Engineer Equipment).

b. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

1-3. Equipment Serviceability Criteria.

For equipment serviceability criteria, refer to technical manual TM 5-4120- -ESC.

1-4. Destruction of Materiel to Prevent Enemy Use.

Demolition and destruction of equipment will be under the direction of the commander and in accordance with TM 750-244-3.

1-5. Administrative Storage.

For procedures, forms and records, and inspections required during administrative storage of this equipment, refer to TM 740-90-1.

## Section II. DESCRIPTION AND TABULATED DATA

1-6. Description.

a. **General.** The air conditioner (fig. 1-1) is used primarily in van type enclosures for providing filtered, conditioned, or heated air as required to maintain service conditions necessary for the efficient operation of electronic equipment and for the comfort of operating personnel housed within the specified vans. It is a completely self-contained, air cooled, electric motor driven unit designed for continuous operation with varying loads. It is equipped with internal ducting to the low side of the evaporator fan so that ventilation air and air from the chemical and biological filter unit may be supplied by the evaporator fan.

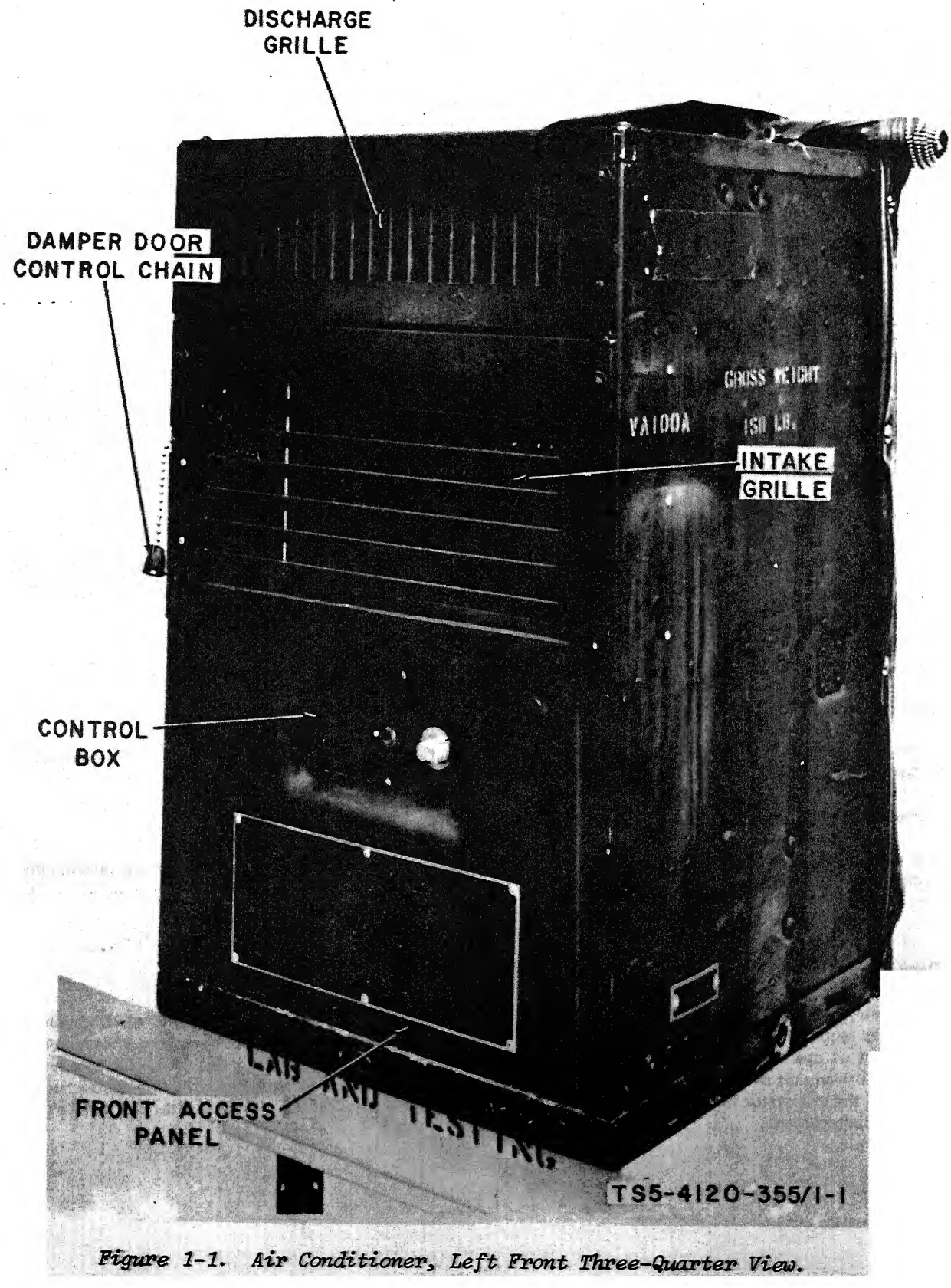



*Figure 1-1. Air Conditioner, Left Front Three-Quarter View.*

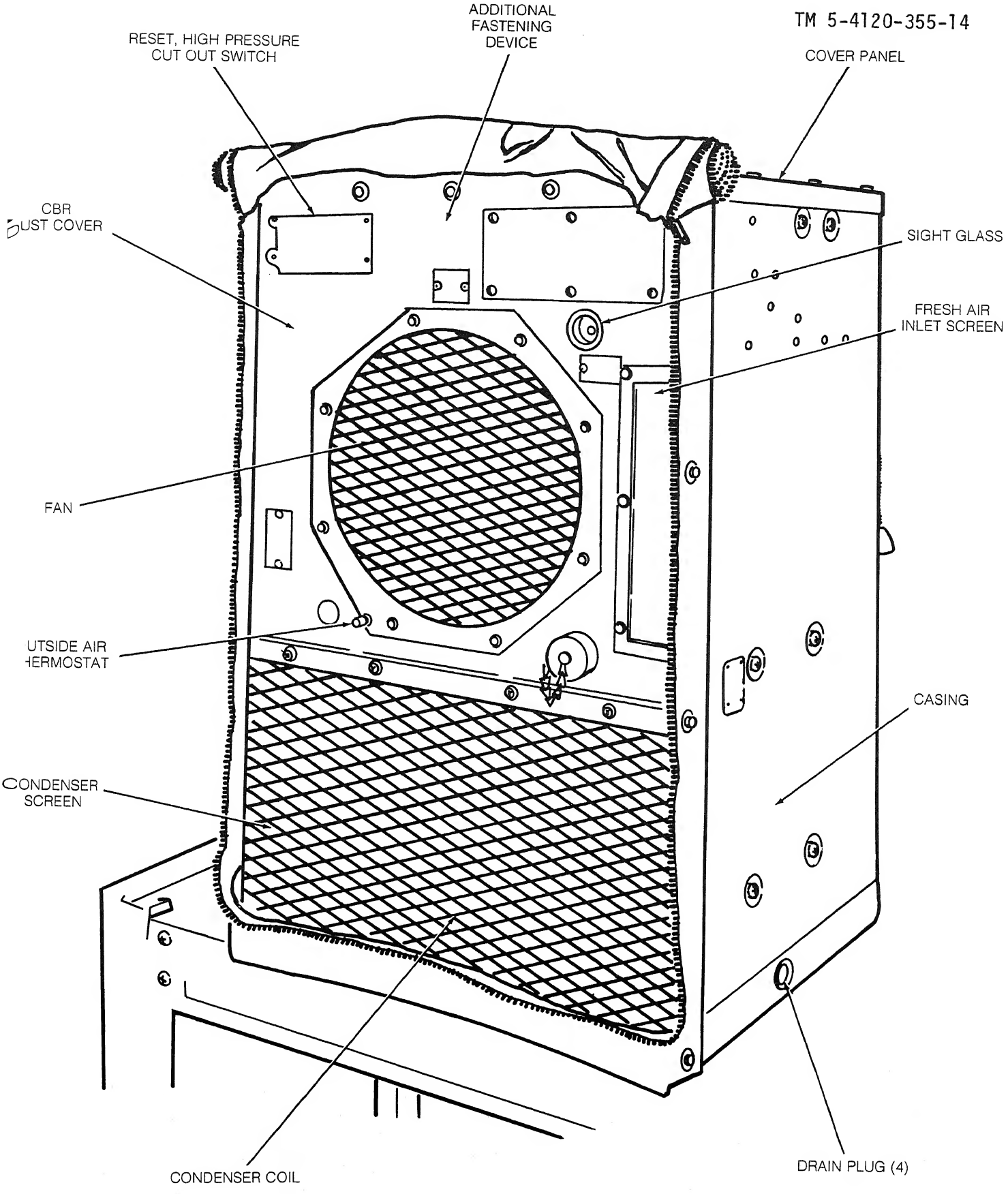



Figure 1-2. Air Conditioner, Right Rear Three-Quarter View

b. **Condensing Section.** The condensing section, located at the bottom of the unit, contains the hermetically sealed compressor, condensing coil, condenser air intake opening, condenser air discharge opening, control panel, junction box, thermostatic switch, power receptacle connector, condenser fan, fan motor, filter drier, suction and discharge access fittings, solenoid valve, capacitors, and high pressure relief valve.

c. **Evaporator Section.** The evaporator section, located in the top of the unit, contains an evaporator coil, evaporator fan, air conditioning filter, intake and discharge grilles, evaporator coil drain pan, expansion valves, electrical heaters, sight glass, fan speed relay, hi and lo pressure switches, solenoid valve, expansion valve, liquid line quench valves, hot gas bypass regulator valve, and a damper to regulate the amount of outdoor air entering the air conditioner.

1-7. Identification and Tabulated Data

a. **Identification.** The air conditioning units have three major nameplates. The information on these plates is listed below.

(1) Air conditioner model VM 6000-400

(a) **Manufacturer's identification plate.**

Located on top of unit.

Title . . . . . .Air Conditioner, Vertical, Compact, 6000 BTU/HR 208 volts, single phase, 400 Hertz
Part No.. . . . . .VM 6000-400
NSN . . . . . .4120-00-935-1607
Manufacturer . . . . . .WEDJ INC.
Contract No. . . . . .DAAKOI-76-C-5845
Serial Nos. . . . . .
Weight. . . . . .137 lbs.
Refrigerant. . . . . .22
Refrigerant charge . . . .39 0z.

(b) Motor identification plate.

Manufacturer . . . . . .Welco Industries Inc.
Cincinnati, OH
Horsepower . . . . . ..5 and .063
RPM . . . . . .3750 & 1850
Frame size . . . . . .4715-21
Amps . . . . . .2.7
Rating. . . . . .Continuous

(c) Compressor identification plate.

Manufacturer . . . . . .Welco Industries Inc.
Cincinnati, OH
Model No. . . . . .MIL-J- -VBC-420
Oil charge . . . . . .30 oz.
Oil type. . . . . .FED VV-L-825 Type IV
Refrigerant. . . . . .22
FLA . . . . . .6
LRA. . . . . .1
Ultimate trip . . . . . .7.8 amps at 71 C.
Circuit Breaker . . . . . .475860

(2) Air conditioner Model VM 6000-115

(a) manufacturer's identification plate.

Title . . . . . .Air Conditioner, Vertical, Campact, 6000 BTU/HR, 115 volts, single phase, 60 Hertz
Part No.. . . . . .VM 6000-115
Manufacturer . . . . . .WEDJ INC.
Contract No. . . . . .DAAKOI-76-C-5845
Serial Nos. . . . . .
Weight. . . . . .151 lbs.
Refrigerant. . . . . .22
Refrigerant charge . . . .39 oz.

(b) Motor identification plate.

Manufacturer . . . . . .Welco Industries Inc.
Cincinnati, OH
Horsepower . . . . . ..40 & .05
RPM. . . . . .3450 & 1750
Frame size . . . . . .4715-20
Amps . . . . . .4.0 & 1.3
Rating. . . . . .Continuous

(c) Compressor identification plate.

Manufacturer . . . . . .Welco Industries Inc.
Cincinnati, OH
Model . . . . . .MIL-J-VBC-610
Oil charge . . . . . .30 oz.
Oil type. . . . . .FED VV-L-825 Type IV
Refrigerant. . . . . .22
FLA . . . . . .12
LRA. . . . . .12
Ultimate trip . . . . . .15 amps at 71 C
Circuit breaker . . . . . .575854

b. **Tabulated Data.**

(1) For model VM 6000-208

(a) Air conditioner.

Manufacturer . . . . . .WEDJ INC.
Model . . . . . .VM 6000-400
Class. . . . . .2
Serial Nos. . . . . .
NSN . . . . . .4120-00-935-1607
Weight. . . . . .137 lbs.

(b) Compressor.

Manufacturer . . . . . .Welco Industries Inc.
Cincinnati, OH
Type. . . . . .Hermetic
Model . . . . . .MIL-J-VBC-420
Capacity . . . . . .6000 BTU/HR

(c) Motor.

Manufacturer . . . . . .Welco Industries Inc.
Cincinnati, OH
Type. . . . . .Open
Model . . . . . .4715-21

(d) Evaporator coil.

Manufacturer . . . . . .Bohn Heat Transfer Div.
Type. . . . . .Copper tubes expanded into aluminum fins

(e) Condenser coil.

Manufacturer . . . . . .Bohn Heat Transfer Div.
Type. . . . . .Copper tubes expanded into aluminum fins

(f) Air filter.

Manufacturer . . . . . .Research Products
Madison, WI
Type. . . . . .Permanent

(g) Dimensions.

Length . . . . . .17 in.
Width . . . . . .17 in.
Height. . . . . .28¼ in.
Weight. . . . . .137 lbs.

(h) Wiring diagram. See figure 1-3. (FO-1).

(i) Base plan. See Figure 4-1.

(2) For model VM 6000-115

(a) Air conditioner.

Manufacturer . . . . . .WEDJ INC.
Model . . . . . .VM 6000-115
Class. . . . . .1
Serial Nos. . . . . .
NSN . . . . . .4120-00-935-1608
Weight. . . . . .151 lbs.

(b) Compressor.

Manufacturer . . . . . .Welco Industries Inc.
Cincinnati, OH
Type. . . . . .Hermetic
Model . . . . . .MIL-J-VBC-610
Capacity . . . . . .6000 BTU/HR

(c) Motor.

Manufacturer . . . . . .Welco Industries Inc.
Cincinnati, OH
Type. . . . . .Open
Model . . . . . .4715-20

(d) Evaporator coil.

Manufacturer . . . . . .Bohn Heat Transfer Div.
Type. . . . . .Copper tubes expanded into aluminum fins

(e) Condenser coil.

Manufacturer . . . . . .Bohn Heat Transfer Div.
Type. . . . . .Copper tubes expanded into aluminum fins.

(f) Air filter.

Manufacturer . . . . . .Research Products
Madison, WI
Type. . . . . .Permanent

(g) Dimensions.

Length . . . . . .17 in.
Width . . . . . .17 in.
Height. . . . . .28¼ in.
Weight. . . . . .137 lbs.

(h) Wiring diagram. See figure 1-4. (FO-2) .

(i) Base plan. See figure 4-1.

Figure 1-3. Wiring diagram, model VM 6000-400 (located in rear of manual) TS 4120-355-14/1-3

Figure 1-4. Wiring diagram, model VM 6000-115 (located in rear of manual) TS 4120-355-14/1-4

1-8. Difference in Models.

This manual covers WEDJ Inc. models VM 6000-115 and VM 6000-400 air conditioners. The differences between the models are in the electrical systems, compressors and motors. Where differences exist, each model is covered in the applicable section of this manual. The single phase unit, model VM 6000-115 runs on 115-volts input. The three phase unit, model VM 6000-400 has no capacitors, two fan relays and a phase sequence relay.

## CHAPTER 2. OPERATING INSTRUCTIONS

2-1. General.

a. The instructions in this section are published for the information and guidance of personnel responsible for operation of the air conditioner.

b. The operator must know how to perform every operation of which the air conditioner is capable. This section gives instructions on starting, stopping, and operating details of the air conditioner. Since nearly every application presents a different problem, the operator may have to vary given procedures to fit the individual job.

2-2. Starting.

a. **Preparation for Starting.**

(1) Perform necessary daily preventive maintenance services, (table 3-1).
(2) Check electrical requirements (para 2-5d).
(3) Model VM 6000-115 must be connected to a 115 volts, 60 hertz, single phase power source.
(4) Model VM 6000-400 must be connected to a 208 volts, 400 hertz, three phase power source.

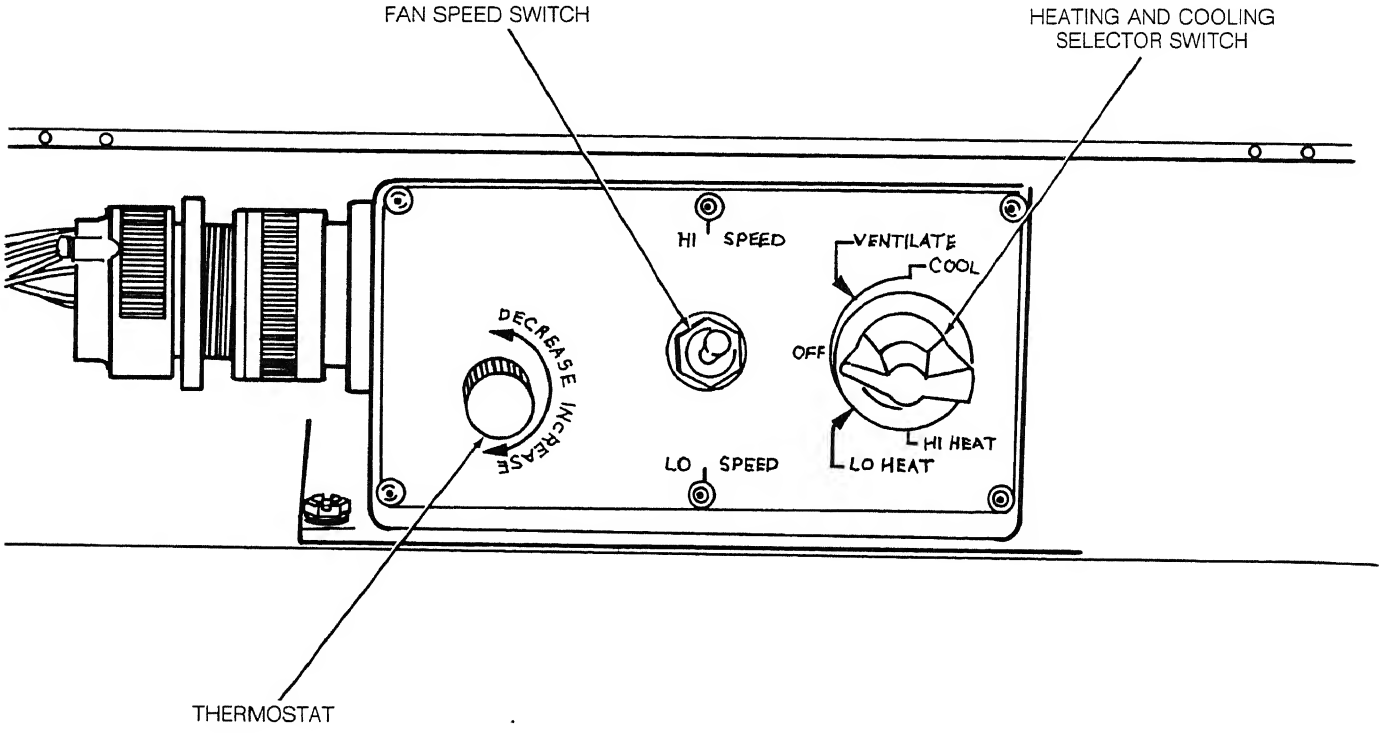



Figure 2-1. Controls and Instruments

b. **Starting.**

(1) **Cooling operation.**

(a) Position thermostat for desired temperature.
(b) Place fan speed toggle switch in desired position.
(c) Place selector switch on COOL position.
(d) For cooling with 100 percent recirculated air, close damper door.
(e) For cooling with fresh makeup air, open damper door and partially close intake grille damper.
(f) For cooling with fresh makeup air drawn through chemical biological filter unit when outdoor air is contaminated, close damper door and partially close intake grille damper.

(2) **Heating operation.**

(a) Position thermostat for desired temperature.
(b) Place fan speed toggle switch in desired position.
(c) Place selector switch on LO-HEAT or HI-HEAT position.
(d) For heating with 100 percent recirculated air, close damper door and open intake grille damper.
(e) For heating with fresh makeup air, open damper door and partially close intake grill damper.
(f) For heating with fresh makeup air drawn through chemical biological filter unit when outdoor air is contaminated, close damper door and partially close intake grille damper.

(3) **Ventilating operation.**

(a) Place selector switch in VENT position.
(b) Place fan speed toggle switch in desired position.
(c) For ventilating operation, open damper door and close grille damper.

NOTE: If the air conditioner fails to start, open front access panel, and push reset control on circuit breaker (fig. 4-12).

2-3. Stopping.

Refer to figure 2-1. Place the selector switch in OFF position.

2-4. Controls and Instruments.

a. **Selector Switch.** Sets the unit for cooling or heating.

b. **Thermostat.** The thermostat is set for the desired temperature.

c. **HI-LO Fan Speed Switch.** Sets the fan for high or low speed.

d. **Liquid Line Sight Glass.** Indicates the condition of the refrigerant.

e. **High Pressure Cutout Control.** The high pressure cutout control located at the upper left rear of the unit (fig. 1-2) is designed to sense line pressure of 400 to 445 psig from the compressor and will cutout at 445 psig (pounds per square inch gage). When the line pressure has reduced to 400 psig, the high pressure cutout control can be reset by pushing the reset button.

f. **Low Pressure Cutout Control.** The low pressure cutout control located at the upper left rear of the unit (fig. 1-2) is designed to sense line pressure 25 to 50 psig to the compressor and will cutout at 25 psig. When the line pressure has increased to 50 psig, the low pressure cutout control can be reset by pushing the reset button.

2-5. Operation Under Usual Conditions.

a. Refer to paragraph 2-2, and start the air conditioner.

b. Refer to paragraph 2-2b. and operate the air conditioner.

## Section II. OPERATION UNDER UNUSUAL CONDITIONS

2-6. Operation in Extreme Cold.

a. **General.** The air conditioner is designed to operate at a maximum low temperature of 50 degrees F. Be sure that all thermostatic controls and dampers are in working order.

b. **Electrical System.** Make sure the electrical system is free of ice and moisture.

**CAUTION: Do not disturb the wiring during cold weather unless absolutely necessary. Cold temperatures make wiring and insulation brittle and are easily broken.**

2-7. Operation in Extreme Heat

a. **General.** The air conditioner is designed to operate satisfactorily at temperatures up to 120 degrees F.

b. **Ventilation.** Allow sufficient room around the air conditioner for adequate air circulation.

NOTE: Do not restrict the flow of air at the intake and discharge openings of the unit.

2-8. Operation in Dusty or Sandy Areas

Clean the condenser coil (para 6-4) and evaporator coil (para 6-3) weekly or more often if necessary. Clean the air conditioning filter, fresh air inlet filter, and condenser screen daily (para 4-17).

2-9. Operation in Salt Water Areas

Wash the exterior of the unit with clean, fresh water at frequent intervals. Do not damage the electrical equipment during the cleaning operation. Coat exposed metal surfaces with rust prooting material. Remove corrosion and paint the exposed metal surfaces.

2-10. Operation at High Altitudes

The air conditioner is designed to operate without special attention at altitudes up to 5,000 feet.

## CHAPTER 3. OPERATOR MAINTENANCE INSTRUCTIONS

### Section I. Lubrication

All bearings are permanently lubricated. No lubrication instructions are required.

### Section II. Preventive Maintenance Checks and Services (PMCS) (DAILY)

3-1. General.

To insure that the air conditioner is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance services to be performed are listed and described in Table 3-1. The sequence numbers indicate the minimum inspection requirements. Defects discovered during operation of the unit will be noted for further correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded together with corrective action taken on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

3-2. Daily Preventive Maintenance.

Table 3-1 contains a tabular listing of preventive maintenance services which must be performed by the operator.

Table 3-1. Operator/Crew Preventive Maintenance Checks and Services

NOTE

Within designated interval, these checks are to be performed in the order listed.

D-During

| Item No. | Interval D | Item To be Inspected | Procedures Check for and have repaired or adjusted as necessary | Equipment is Not Ready/ Available if: |
|---|---|---|---|---|
| 1 | ● | Air Conditioner Unit | During starting and operation, check for unusual noise, rough running and excessive vibration. Check for lack of power or any indication of a failing or defective component. If suspected, notify organizational maintenance. | |

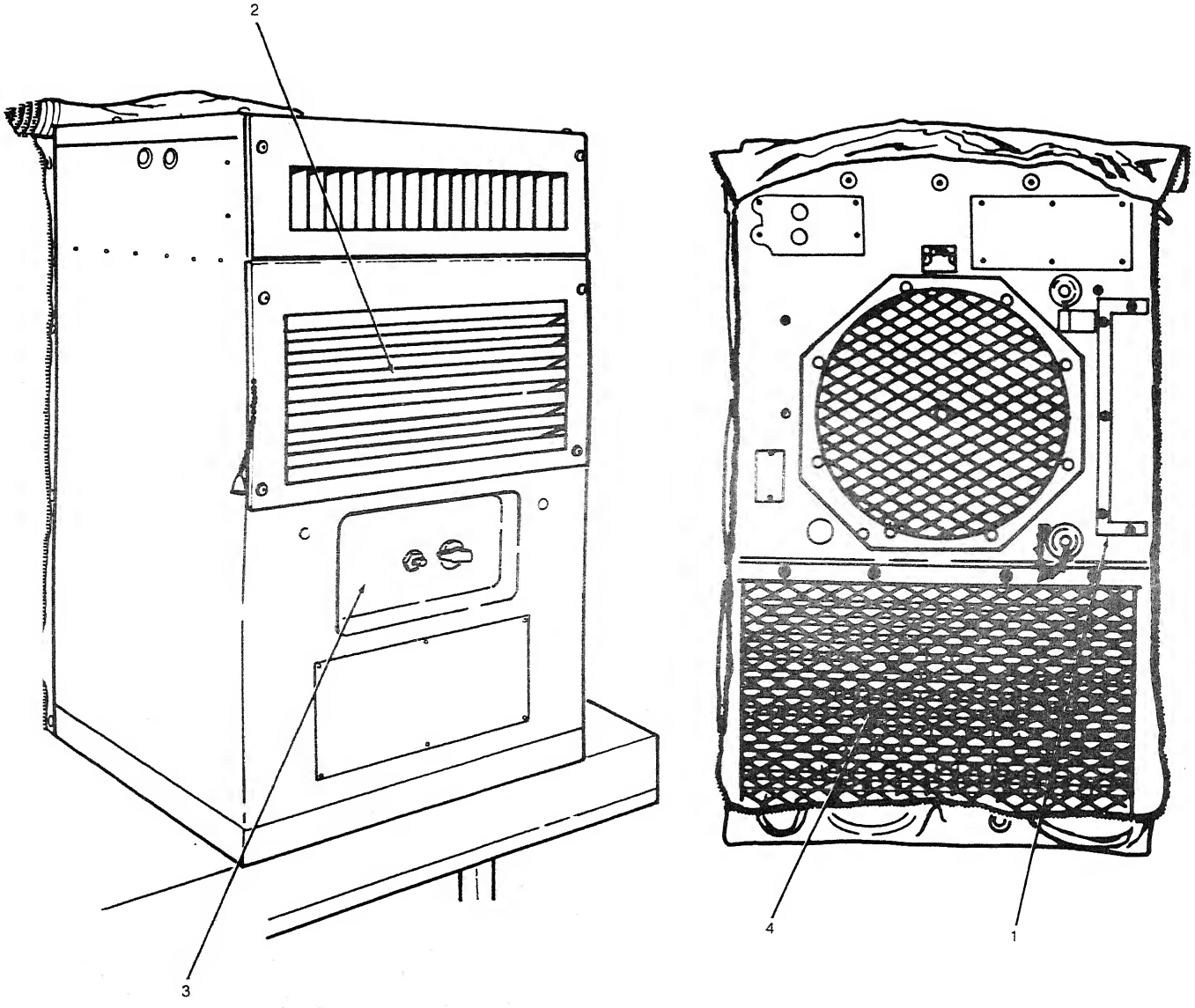



Figure 3-1. Preventive Maintenance Checks and Services (PMCS)

## Section III. Troubleshooting

### 3-3. General.

a. This section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the air conditioner. Each malfunction for an individual component, unit or system is followed by a list of tests or inspections which will help you to determine corrective actions to take. You should perform the tests/ inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

c. The table lists the common malfunctions which you may find during the operation or maintenance or the air conditioner or its components.

### 3-4. Troubleshooting

Troubleshooting of the air conditioner is given in table 3-2.

NOTE: Before you use this table, be sure you have performed all applicable operating checks.

Table 3-2. Troubleshooting

| MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|
| 1. COMPRESSOR FAILS TO START |
| Step 1. Set selector switch to COOL position (fig. 4-2A).<br>If compressor does not start, go to step 2. |
| Step 2. Reset circuit breaker (fig. 2-1).<br>If compressor does not start, go to step 3. |
| Step 3. Check if high pressure cutout switch is closed.<br>Push reset button to reset cutout switch if open. |
| Step 4. Check if low pressure cutout switch is closed.<br>Push reset button to reset cutout switch if open |

## Section IV. MAINTENANCE PROCEDURES

### 3-5. General

Instructions in this section are published for the information of the operator to maintain the air conditioner.

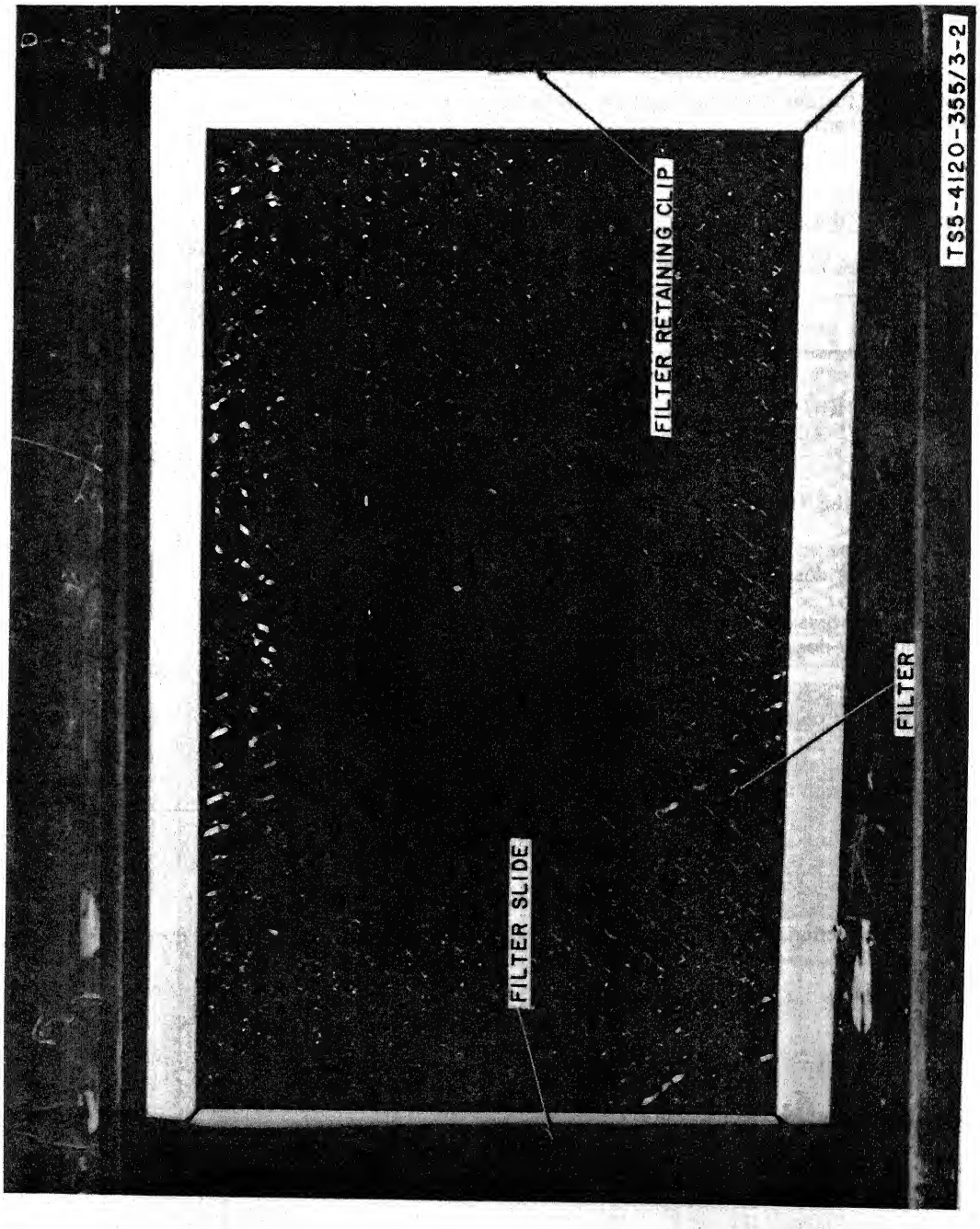



*Figure 3-2. Air Filter, Removal and Installation.*

3-6. Air Filter Inspection and Service

a. **Inspection.**

(1) Remove intake grille, fig. 4-5.
(2) Remove air filter, fig. 3-2.
(3) Inspect filter for dirt.

b. **Service.**

(1) Wash filter in hot water or approved solution.
(2) Dry with compressed air.
(3) Spray with light coat of oil.

3-7. Panels, Grilles, and Screens Inspection

Refer to figures 4-4 and 4-5 and inspect panels, grilles, and screens.

# CHAPTER 4. ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

## Section 1. Service Upon Receipt of Equipment

4-1. Unloading the Equipment.

a. Remove any blocking or tiedowns that may have been used to secure the item to the carrier. The air conditioner is shipped in a wooden carton, the base of which is raised to provide for insertion of tongs of a forklift.

b. Use a forklift or other suitable lifting device to remove unit from carrier. If necessary, the unit may be un' aded manually.

**CAUTION: Use care in handling to avoid damaging the air conditioner.**

4-2. Unpacking the Equipment.

a. **General.** Move air conditioner to installation site before removing shipping container. Cut the metal bands and remove top, end, and sides of carton, and the Kimpak covering. Remove bolts securing base of unit to carton, and using the handles, lift unit from carton.

b. **Depreservation.** Prior to placing unit in operation, accomplish depreservation in accordance with instruction outlined in DA Form 2258 (Depreservation Guide of Engineer Equipment). DA Form 2258 is attached or near the operational controls.

4-3. Inspecting and Servicing Equipment.

a. Perform quarterly preventive maintenance services (fig. 4-3).

b. Inspect entire air conditioner for signs of damage, paying particular attention to evaporator and condenser coils.

c. The air conditioner contains a full operating charge of refrigerant and compressor oil. No further service is required.

4-4. Installation of Separately Packed Components.

a. **General.** The air conditioner is basically a self-contained unit. However, in certain installations it may become desirable to utilize the sound attenuator and/or blockoff plate with an electrical receptacle, and use a remote control box.

b. **Blockoff Plate.** The blockoff plate is provided for installation when the controls are removed for remote control operation. The blockoff plate provided must be used so that no air will enter the lower Compartment.

Refer to figure 4-2 and install the blockoff plate.

4-5. Installation Instructions

a. **General.** Set air conditioner in a level position to allow proper condensate draining (operation will be satisfactory with unit sitting at a slight angle (5 degree max) and using one of the alternate drain connections.

b. **Locating the Unit.** The front access panel and discharge and intake grilles are removable for normal service and maintenance, and must always be unobstructed to allow sufficient air for condensing purposes. The discharge and intake openings at the front of the unit should be free from obstruction to permit maximum unit capacity.

NOTE: Remove discharge and intake grilles and filter, if unit is to be used with ducts carrying air to and from the conditioned space. Install grilles and filter in the duct. Remove the chemical and biological (CB) inlet cover (fig. 4-4) if a CB filter is to attached to the unit.

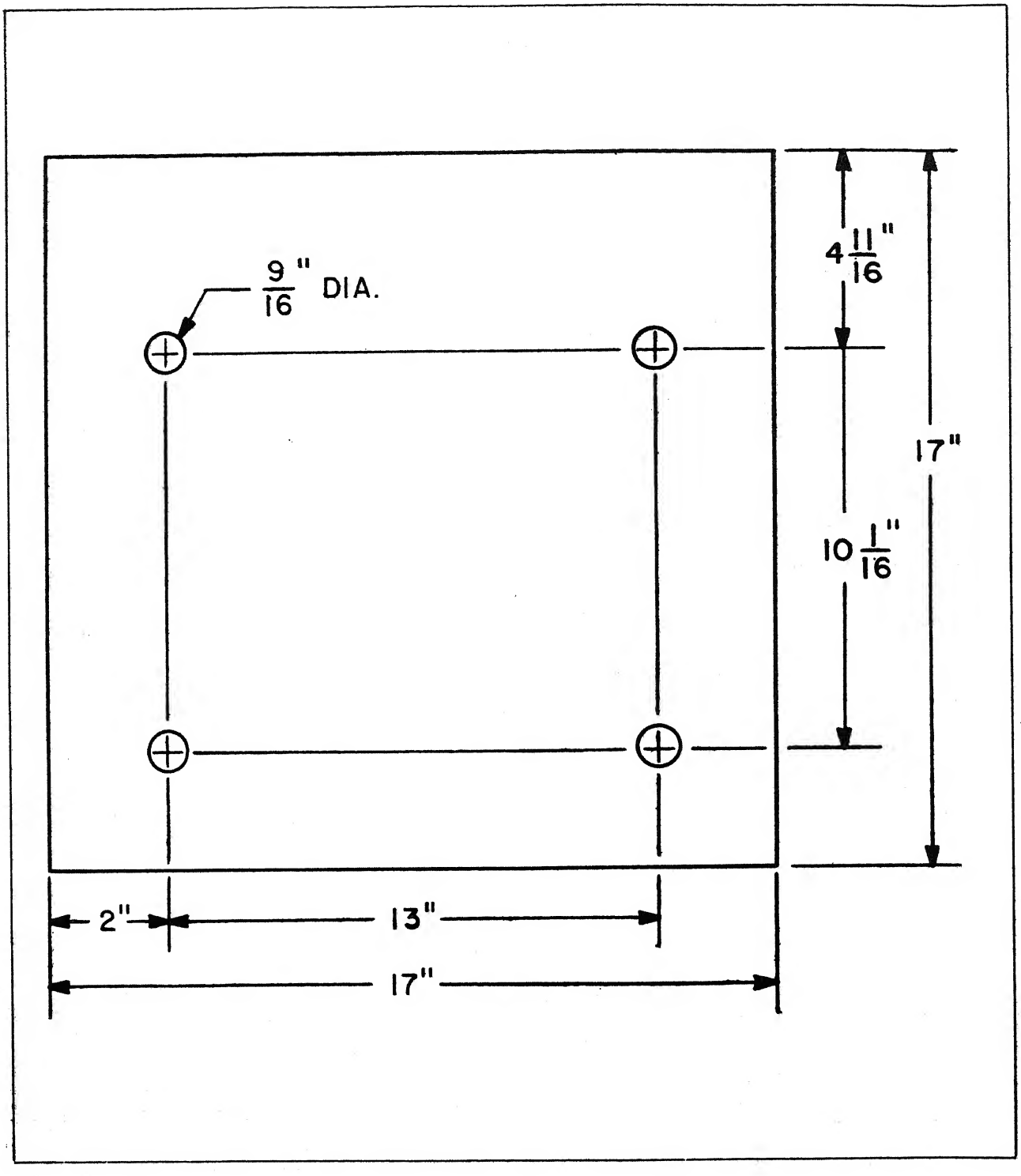



*Figure 4-1. Base Plan.*

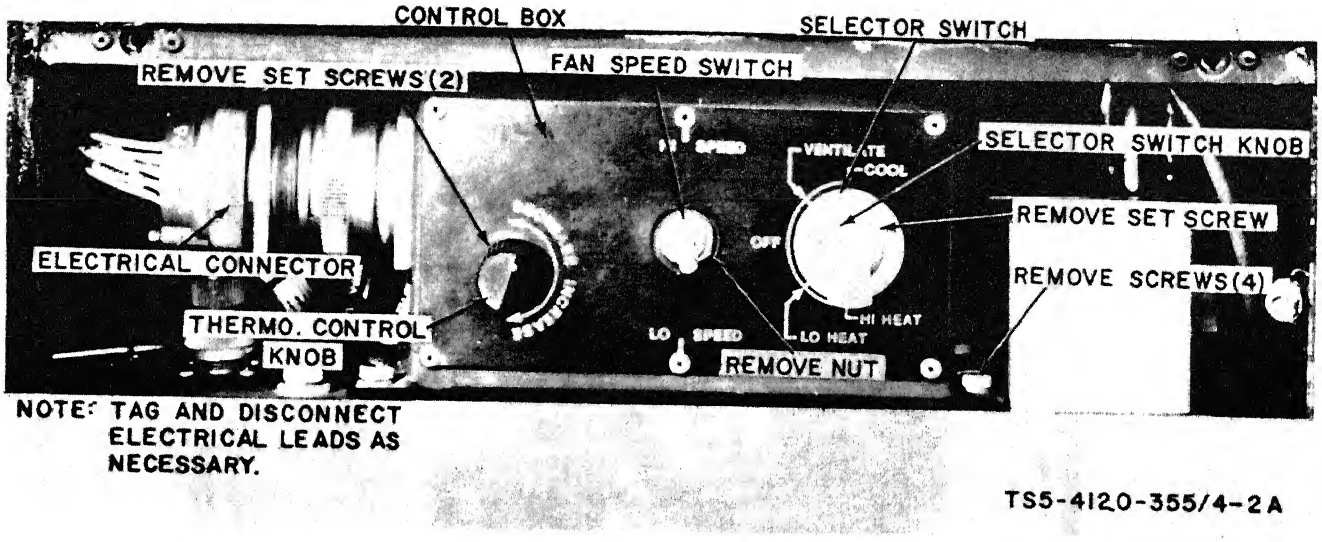



*Figure 4-2A. Control Box and Control Box Back Panel, Removal and Installation.*

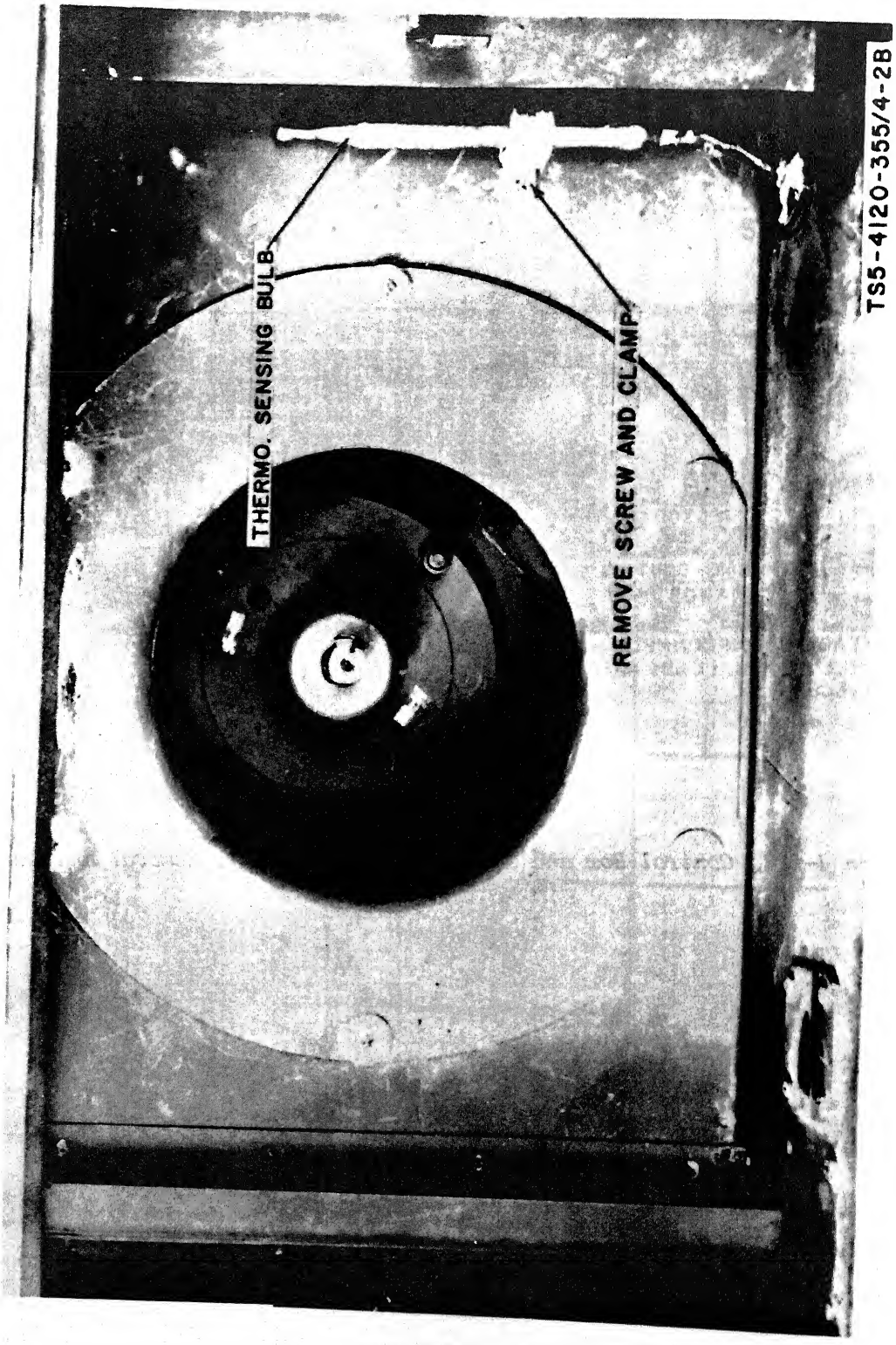
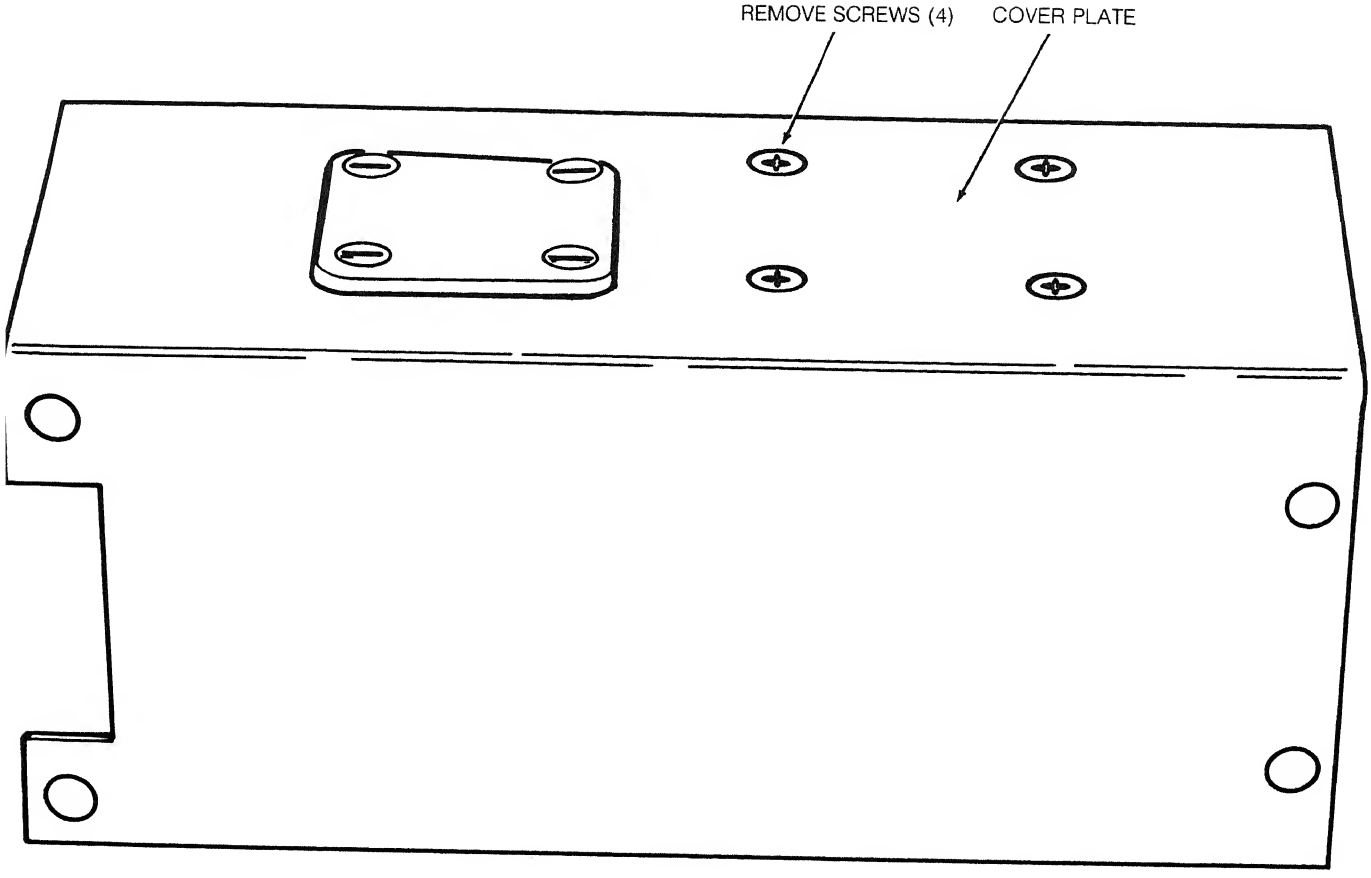



*Figure 4-2B. Control Box and Control Box Back Panel, Removal and Installation (Continued).*




NOTE: CONNECT CONTROL BOX AND BLOCK OFF RECEPTACLE WITH SUITABLE CABLE.

Figure 4-2C. Control Box and Control Box Panel, Removal and Installation (Continued).

## BLOCK OFF PLATE

STEP 1 - REMOVE COVER PLATE FROM BLOCK OFF PLATE AND INSTALL ELECTRICAL CONNECTOR FROM REAR. SECURE WITH SCREWS (4).

STEP 2 - REPLACE CONTROL BOX WITH BLOCK OFF PLATE AND SECURE WITH SCREWS (4).

c. **Installing Unit.** Bolt unit to the floor or other flat surface. Refer to base plan (fig. 4-1) for dimensions. An additional fastening device (fig. 1-2) is located on the upper rear side for additional mounting rigidity if required. Connect drain hose to drain fitting at bottom of unit to lead condensate away from unit. The unit is provided with four drain plugs installed, one on each side of unit. Remove plug prior to installing the drain hose.

d. **Power Sources.**

(1) Model VM 6000-115 operates on 115-volts, 60 hertz, single phase.
(2) Model VM 6000-400 operated on 208-volts, 400 hertz, three phase.

e. **Power Receptacle Connector.** Connector is located at the rear of the unit (fig. 1-2) above the condenser coil air inlet. Connect the power supply source to this connector using a proper plug or to an alternate connector. Alternate connector openings are provided at both sides of the unit and front of the unit. Any location may be used by interchanging the power connector at the rear and one of the cover plates at the sides or front of the unit. Be sure to attach cover plate over unused location at the rear of the unit to prevent air from being drawn through the opening.

f. **Remote Control.**

(1) **General.** The control box (fig. 4-2A) may be removed from the unit and used for remote control operation of the air conditioner. A blockoff plate provided must be used when this control box is used as a remote control.

(2) **Remote control connection.**

(a) Disconnect power source from unit.
(b) Refer to figure 4-2A, and remove control box from unit.
(c) Remove cable between control box and junction box.
(d) Connect remote control cable between control box and junction box.
(e) Carry control box to remote operating position and place on a flat surface.
(f) Reconnect power source to the air conditioner.
(g) Refer to para 2-2 and operate the unit at the remote position.

## Section II. Movement to New Worksite

4-6. Dismantling for Movement.

a. **General.**

(1) Shut off electrical power supply to the air conditioner and disconnect power cable from the unit.
(2) Disconnect drain hose from the unit.

NOTE: Disconnect all duct work and remote control cable if used with unit.

(3) Unbolt unit from mounting surface.

b. **Short Distance Movement.** Use a forklift and lift the unit at base, or carry unit to new worksite using recessed handles at sides of unit.

c. **Long Distance Movement.** Crate the air conditioner, providing adequate protection to grilles and control box. Refer to TM 38-250 for instructions in crate fabrication. Provide suitable blocking and tiedowns to prevent unit from shifting during transfer.

4-7. Reinstallation After Movement.

Reinstall the air conditioner as instructed in paragraph 4-5.

## Section III. Repair Parts, Special Tools, and Equipment

4-8. Special Tools and Equipment

No special tools or equipment are required.

4-9. Repair Parts

Repair parts are listed and illustrated in the repair parts and special tools list, TM5-4120-355-24P, covering organizational maintenance for the air conditioner.

## Section IV. Lubrication Instructions

No lubrication is required.

## Section V. Preventive Maintenance Checks and Services (PMCS) (QUART)

4-10. General

The necessary preventive maintenance services to be performed are listed and described in table 4-1. The sequence numbers indicate the minimum inspection requirements. Defects discovered during operation of the unit will be noted for further correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded together with corrective action taken on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

4-11. Quarterly Preventive Maintenance

Table 4-1 contains a tabular listing of preventive maintenance services which must be performed by organizational maintenance personnel. The sequence numbers are listed consecutively and indicate the minimum requirements.

Table 4-1. Organizational Preventive Maintenance Checks and Services

Q-Quarterly

| Item No. | Interval Q | Item to be Inspected | Procedures |
|---|---|---|---|
| 1 | ● | Air Filter | Clean and service as required. |
| 2 | ● | Evaporator Coil | Clean and service as required. |
| 3 | ● | Condenser Coil | Clean and service as required. |
| 4 | ● | Fan Motor | Clean and service as required. Turn shaft to be sure bearings are not defective. |
| 5 | ● | Air Conditioner Unit | Lubricate all movable connections and linkage with SAE 30 oil. Check for loose, missing, or damaged components. Clean and service as required. |
| 6 | ● | Sight Glass | Check for damaged or broken glass. Check for full condition of unit. |
| 7 | ● | Wiring | Look for broken or loose wires on connections. |
| 8 | ● | Refrigerant | Inspect refrigerant hoses and tubing for signs of leakage abrasion, tearing, kinking, etc. |

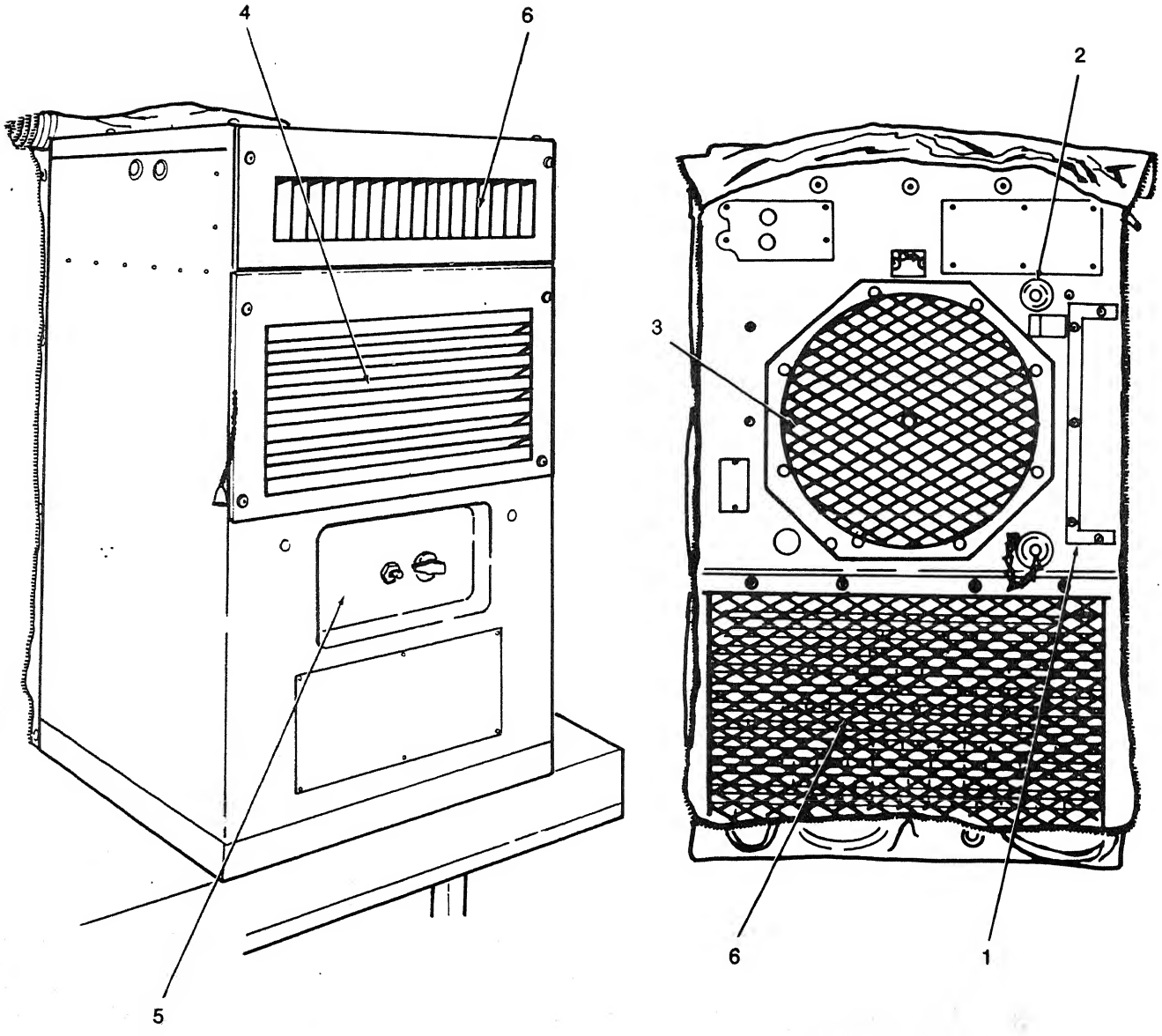



Figure 4-3. Preventive Maintenance Checks and Services (PMCS)

## Section VI. Troubleshooting

### 4-12. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the air conditioner and its components. Each trouble symptom stated is followed by a list of probable causes. The possible remedy recommended is described opposite the probable cause. Any trouble beyond the scope of organizational maintenance shall be reported to direct support maintenance.

### 4-13. Troubleshooting

Troubleshooting of the air conditioner is given in table 4-2.

NOTE: Before you use this table, be sure you have performed all applicable operating checks.

Table 4-2. Troubleshooting

| MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|
| 1. COMPRESSOR STARTS BUT GOES OUT ON OVERLOAD |
| Step 1. Listen if condenser fan is operating.<br>Check motor leads and power line going to motor. Correct as required. |
| Step 2. Condenser coil may be blocked.<br>Clean condenser coil |
| 2. LITTLE OR NO HEATING CAPACITY |
| Step 1. Check if selector switch is at HEAT.<br>Set switch to HEAT. |
| Step 2. Check if there is sufficient air movement over evaporator.<br>Clean air filter. |
| Step 3. Check electrical connections to heater.<br>Correct heater wiring. |
| 3. SUCTION PRESSURE INADEQUATE |
| Step 1. Check sight glass for appearance of flash gas.<br>Add refrigerant. |
| 4. LOW SUCTION AND DISCHARGE PRESSURES |
| Step 1. Check sight glass for appearance of flash gas.<br>Report lack of refrigerant to higher maintenance. |
| Step 2. Check if air filter is clean.<br>Clean air filter. |

## Section VII. Radio Interference Suppresion

This section is not applicable to this equipment.

## Section VIII. Maintenance of Housing Assembly

### 4-14. General

The air conditioner is constructed with removable aluminum panels. The front access panel provides access to the junction box, control panel, and access fittings. A discharge grille protects the evaporator and controls the direction of discharge of conditioned air. The intake grille protects the air conditioning filter and regulates the amount of air returned to the unit. The condenser coil grille and fan guard protects the condenser coil and fan. A fresh air inlet screen permits the entry of outside air and is controlled by the damper door with the control spring and chain. The cover panel covers the top of the unit.

**WARNING: Disconnect the air conditioner from power source before performing any maintenance on the components of the unit.**

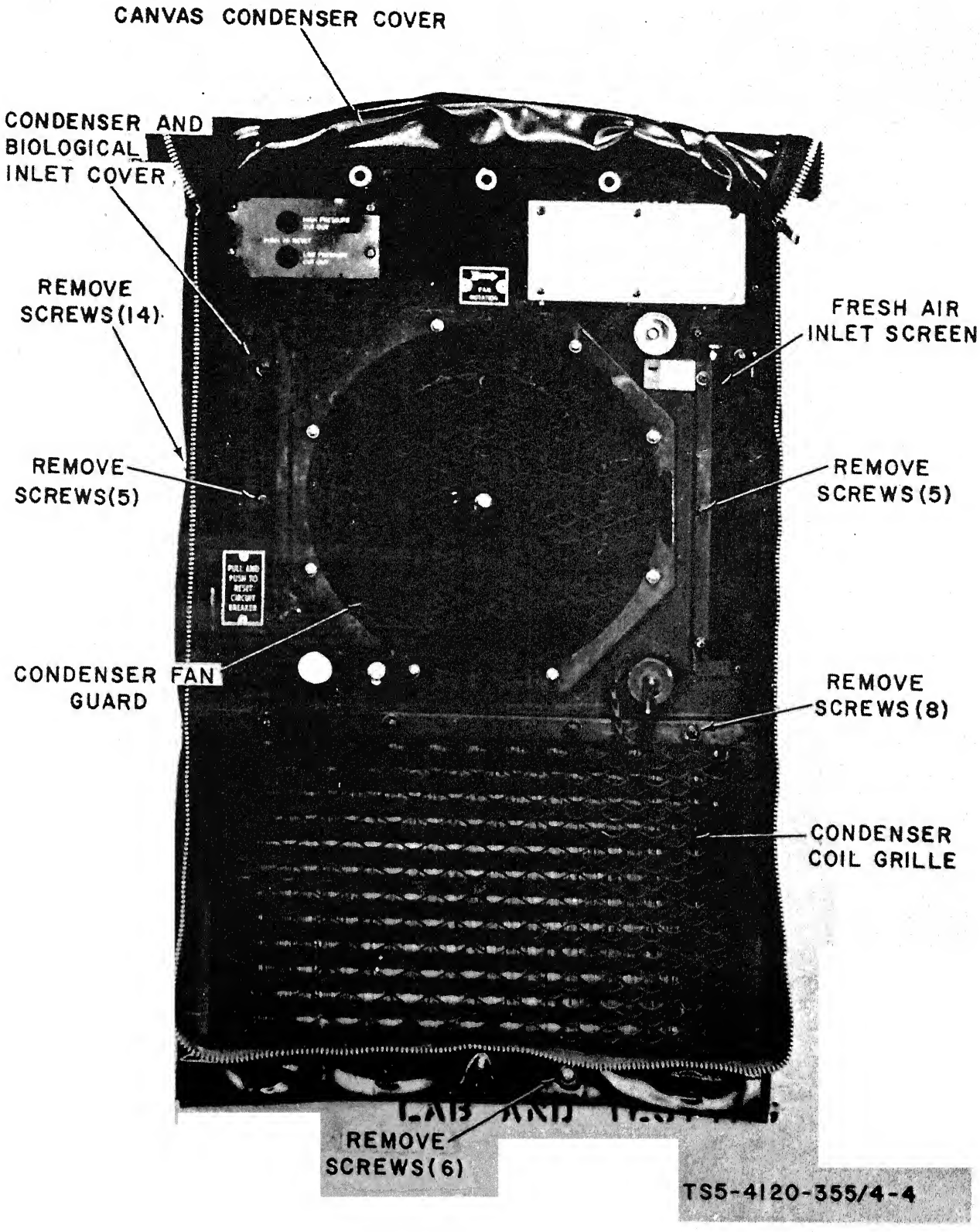



*Figure 4-4. Fresh Air Inlet Screen, Chemical and Biological Inlet Cover, Condenser Fan Guard, and Condenser Coil Grille, Removal and Installation.*

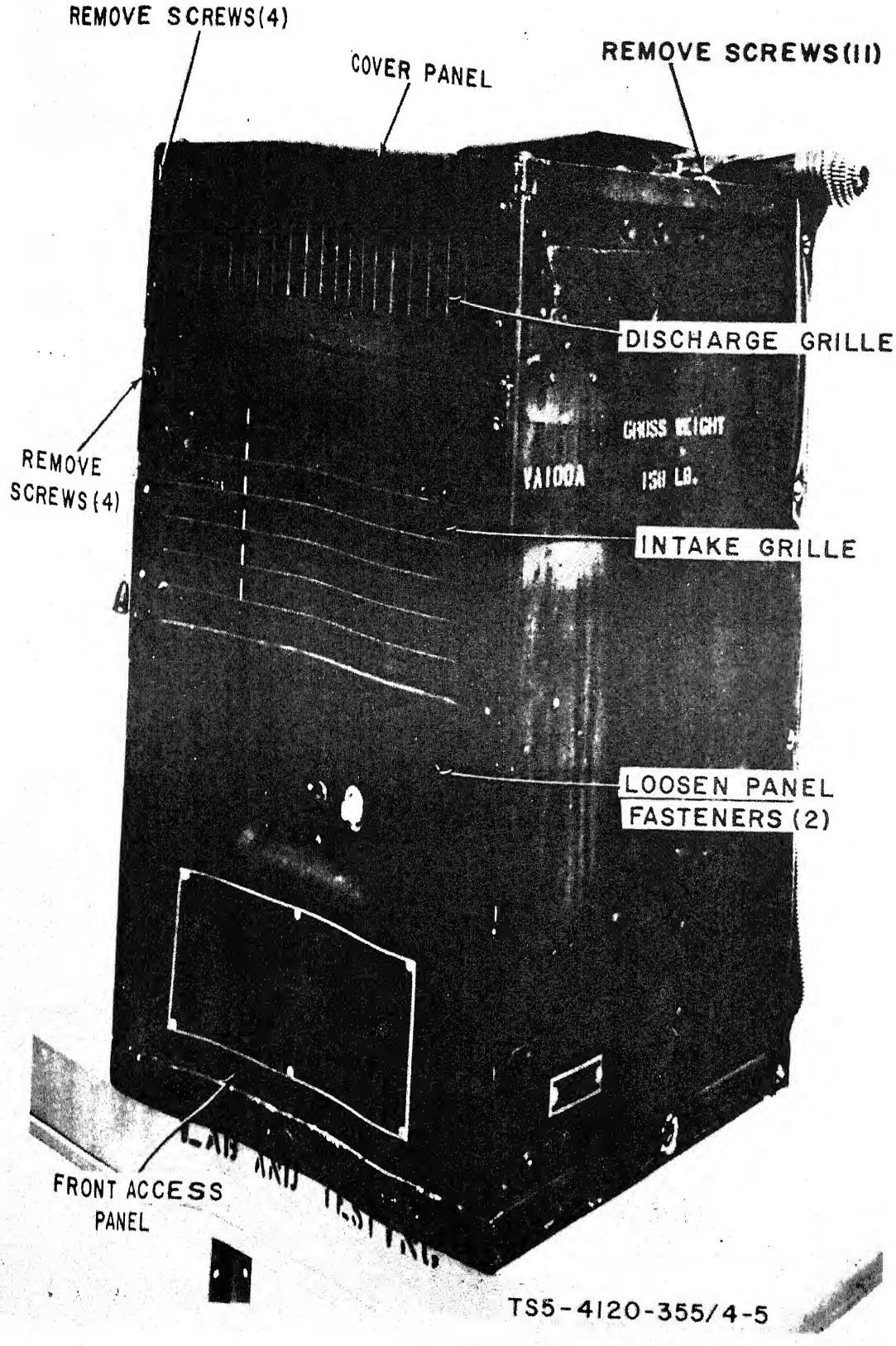



*Figure 4-5. Discharge Grille, Intake Grille, Front Access Panel, Removal and Installation.*

4-15. Top Panel, Discharge Grille, Intake Grille, and Front Access Panel.

a. **Removal.** Refer to figure 4-5 and remove panels and grilles.

b. **Inspection and Repair.** Inspect for minor dents, and cracked or chipped paint. Repair minor damage and repaint.

c. **Installation.** Refer to figure 4-5 to install panels and grilles.

4-16. Canvas Condenser Cover.

a. **Removal.** Refer to figure 1-2. Remove retaining hardware and lift off cover.

b. **Inspection and Repair.** Inspect for rips or tears. Repair with waterproof tape.

c. **Installation.** Place cover in position and secure with retaining hardware.

4-17. Fresh Air Inlet Screen, CB Inlet Screen, Condenser Fan Guard and Condenser Coil Grille.

a. **Removal.** Refer to figure 4-4. Remove fresh air inlet screen, CB inlet cover, condenser fan guard, and condenser coil grille.

b. **Inspection.** Inspect for minor dents and cracked or chipped paint. Repair minor damage and repaint.

c. **Installation.** Install the fresh air inlet screen, CB inlet cover, condenser fan guard, and condenser coil grille.

## Section IX. General Organizational Maintenance Instructions

4-18. Compressor.

Test for continuity across motor windings with multimeter set on OHMS. Refer to wiring diagram, figure 1-3, to establish points of continuity.

4-19. Fan Motor.

a. **Removal.** Refer to figure 4-6 and remove the motor.

b. **Inspection and Testing.**

(1) Inspect for dents, cracks, and broken or damaged leads.

(2) Test for continuity across windings with a multimeter set on OHMS. Refer to figure 1-3 to establish points of continuity.

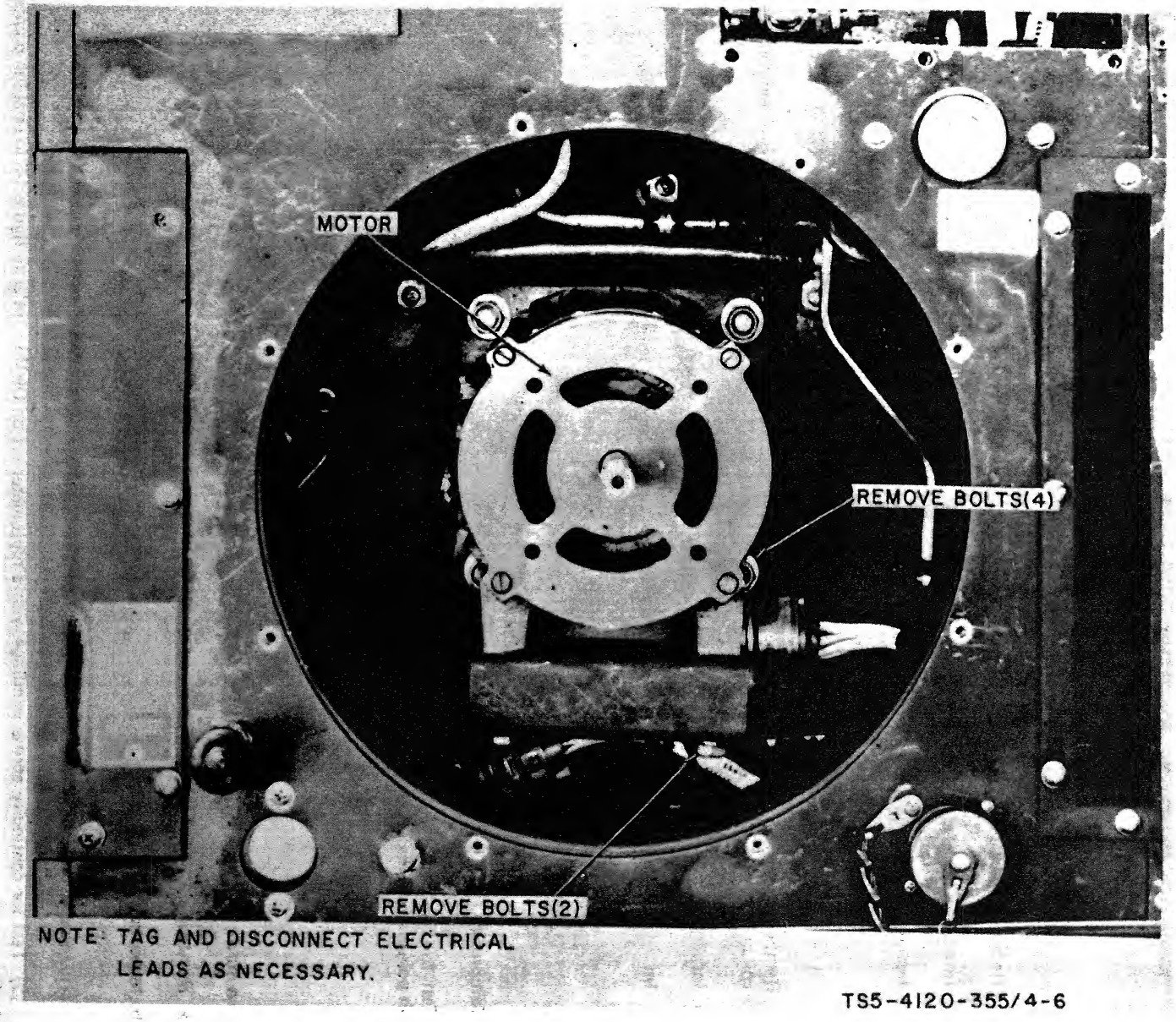



*Figure 4-6. Fan Motor, Removal and Installation.*

4-20. Capacitors (Model VM 6000-115 only).

a. **Removal.** Refer to figure 4-7 and remove 4-7 and remove capacitors.

b. **Inspection and Testing.**

(1) Inspect for cracked case and broken or damaged contacts.

(2) Use a multimeter set on OHMS. Refer to wiring diagram, figure 1-3. A full scale reading should be made with a steady return to zero.

c. **Installation.** Refer to figure 4-7 and install capacitors.

4-21. Evaporator Fan and Inlet Ring.

a. **General.** The units are equipped with a centrifugal inclined blade evaporator fan. The fan reduces excessive vibration and noise.

b. **Removal.** Refer to figure 4-8 and remove inlet ring and evaporator fan.

c. **Installation.** Refer to figure 4-8 and install inlet ring and evaporator fan.

4-22. Condenser Fan.

a. **Removal.** Refer to figure 4-9 and remove condenser fan.

b. **Inspection.** Inspect fan for dents, cracks, bends, and chipped paint.

c. **Installation.** Refer to figure 4-9 and install condenser fan.

4-23. Fan Motor Relays.

a. **General.** Fan motor relays are located in the top of theunit, figures 4-10 and 4-11. The relay starts the fan motor and controls the high and low speeds.

b. **Removal.** Refer to figures 4-10 and 4-11 and remove the fan motor relays.

c. **Inspection and Testing.**

(1) Inspect for pitted or burned contacts.

(2) Test for continuity across coil with multimeter set on OHMS. Refer to wiring diagram, figure 1-3, to establish points of continuity.

d. **Installation.** Refer to figures 4-10 and 4-11 to establish points of continuity.

4-24. Control Box.

a. **General.** The control box houses the selector switch, thermostat, and hi-lo fan speed switch and is mounted on the junction box. The selector switch is manually operated, five-position switch. Automatic control of both heating and cooling cycles is provided by the thermostat. The hi-lo fan speed switch controls the fan speed. The control box may be used in a remote position by utilizing a blockoff plate and a remote control cable, figure 4-2A and C.

4-25. Selector Switch.

a. **Removal.** Refer to figure 4-2A and remove the selector switch.

b. **Testing.** Test for continuity across coils using a multimeter set on OHMS. Refer to wiring diagram figure 1-3 to establish points of continuity.

c. **Installation.** Refer to figure 4-2A and install selector switch.

4-26. Hi-Lo Fan Speed Switch.

a. **Removal.** Refer to figure 4-2A and remove fan speed switch.

b. **Testing.** Test for continuity. Refer to wiring diagram, figure 1-3, to establish points of continuity.

c. **Installation.** Refer to figure 4-2A and install fan speed switch.

4-27. Thermostat.

a. **Removal.** Refer to figure 4-2A and remove thermostat.

b. **Testing.** Test for continuity using multimeter set on OHMS. Refer to wiring diagram, figure 1-3, to establish points of continuity.

c. **Installation.** Refer to figure 4-2A and install thermostat.

4-28. Junction Box.

a. **Removal.** Refer to figure 4-12 and remove junction box.

b. **Installation.** Refer to figure 4-12 and install junction box.

4-29. Fuses.

a. **Removal.** Refer to figure 4-12 and remove fuses from holders located in junction box.

b. **Inspection and Testing.**

(1) Inspect for cracked or broken case.

(2) Test for continuity through fuse with multimeter set on OHMS.

c. **Installation.** Refer to figure 4-12 and install fuse in fuseholder.

4-30. Transformer.

a. **Removal.** Refer to figure 4-12 and remove transformer.

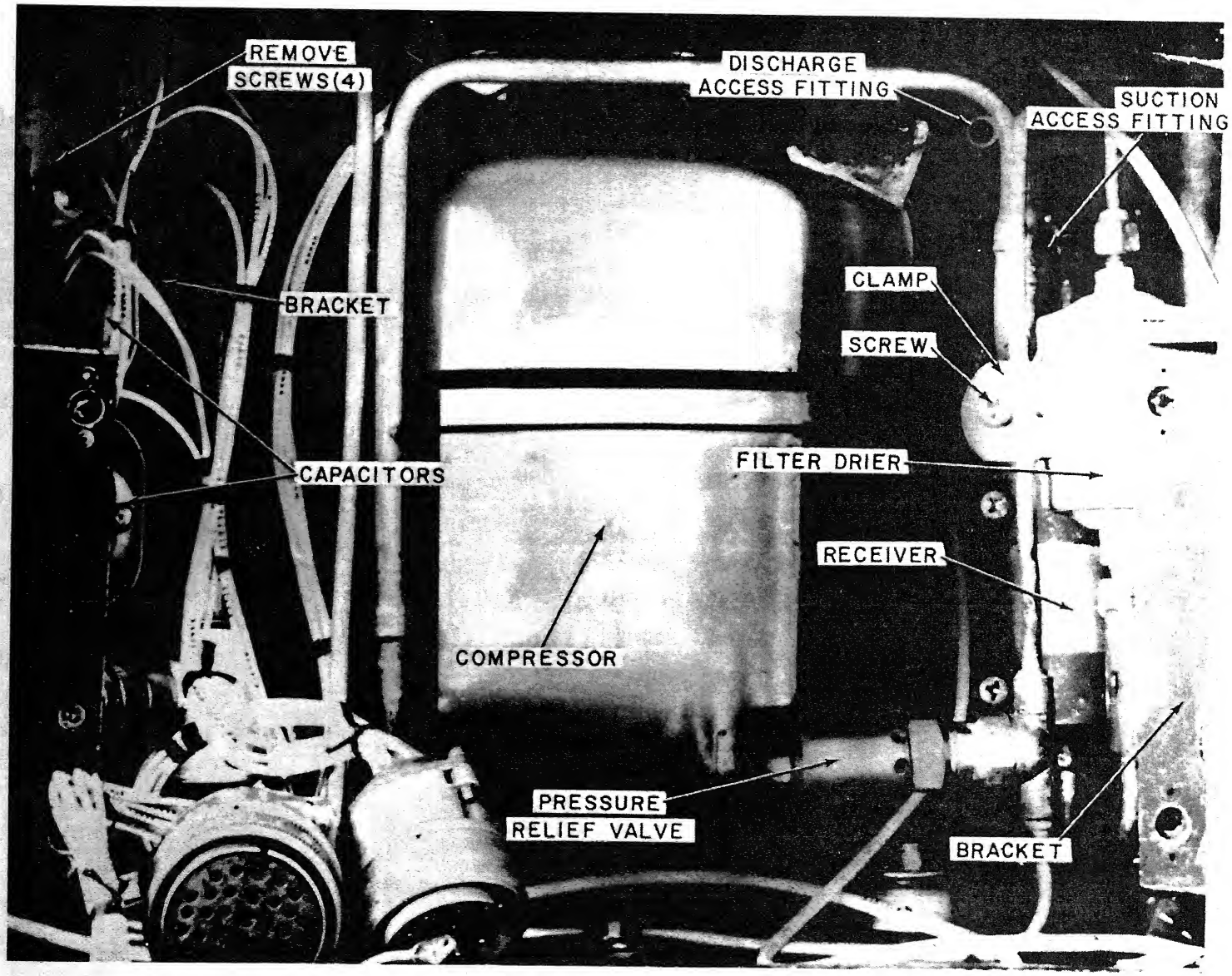



*Figure 4-7. Compressor, Pressure Relief Valve, Receiver, Liquid Line Solenoid Valve, Filter-Drier, Drain Tube, Removal and Installation.*

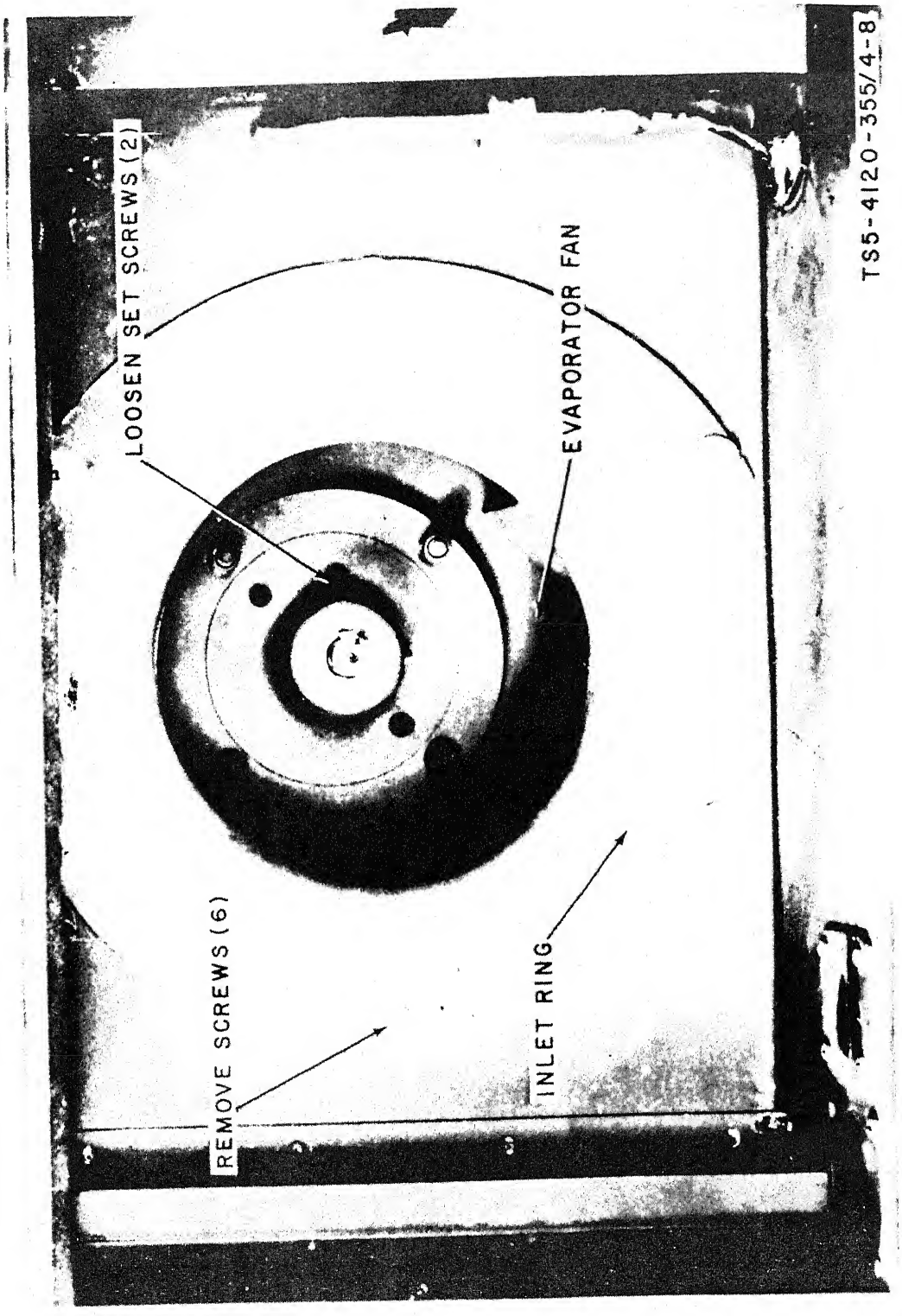



*Figure 4-8. Evaporator Fan, Inlet Ring, and Thermostat Sensing Bulb, Removal and Installation.*

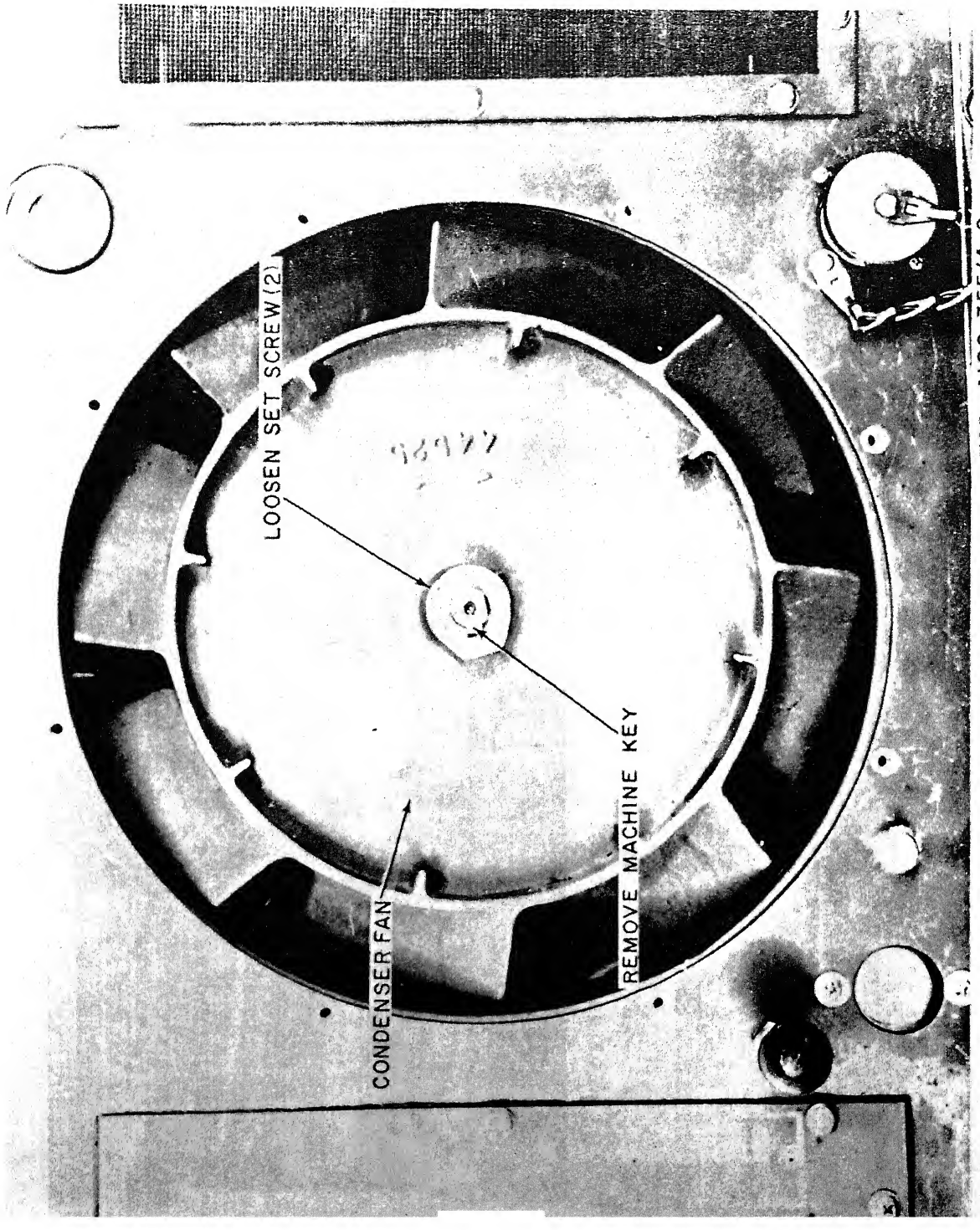
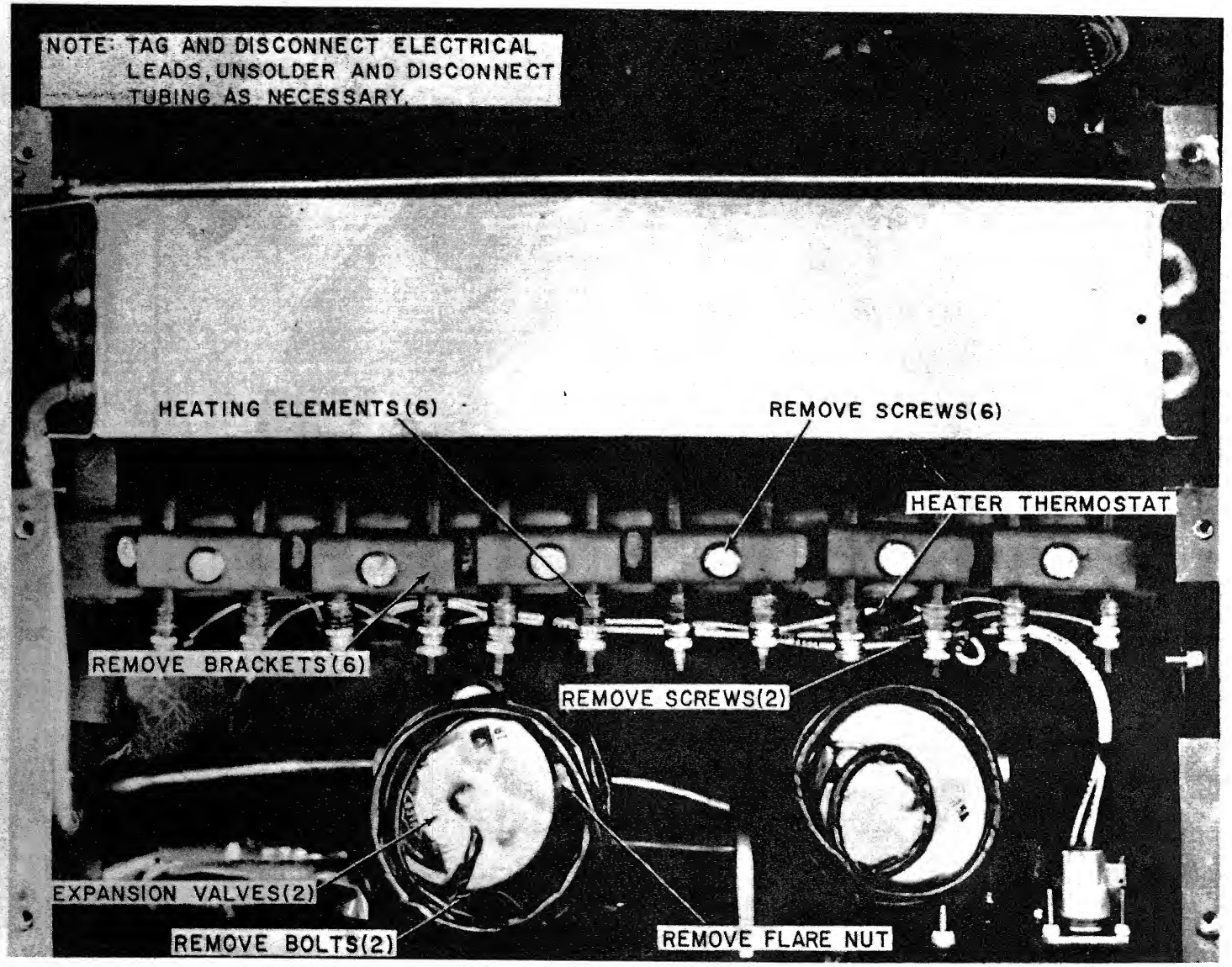
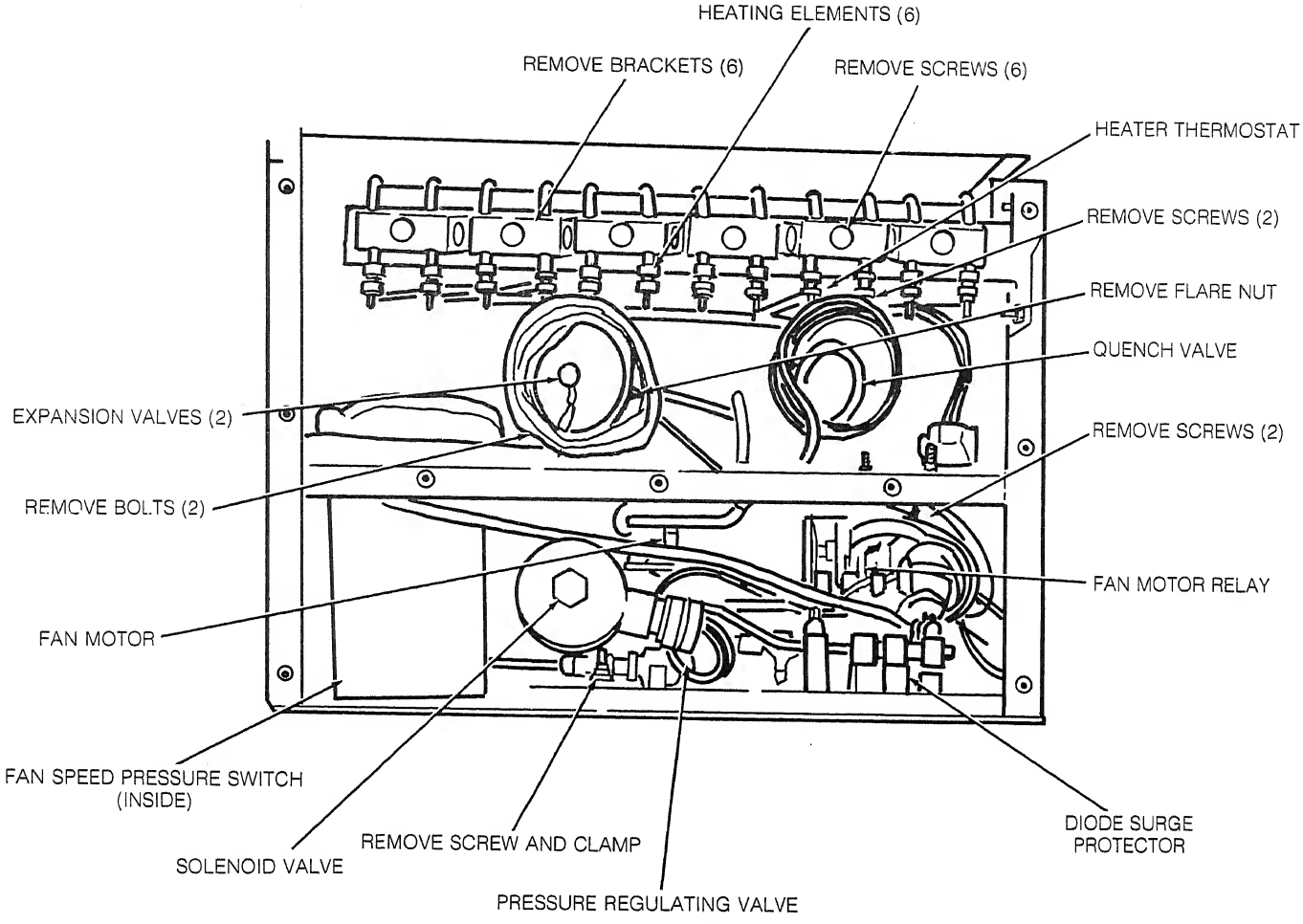



*Figure 4-9. Condenser Fan, Removal and Installation.*




TS5-4120-355/4-10

*Figure 4-10. Model VM 6000-115 Heating Element, Evaporator Coil, Expansion Valve, Fan Motor Relay, Equalizer Solenoid Valve, Pressure Regulating Valve, Diode Surge Protector, Heater Thermostat, Removal and Installation.*




NOTE: TAG AND DISCONNECT ELECTRICAL LEADS, UNSOLDER AND DISCONNECT TUBING AS NECESSARY

Figure 4-11. Model VM 6000-400 Heating Element, Fan Speed Pressure Switch, Expansion Valve, Fan Motor Relay, Equalizer Solenoid Valve, Pressure Regulating Valve, Diode, Surge Protector, Heater Thermostat, Removal and Installation

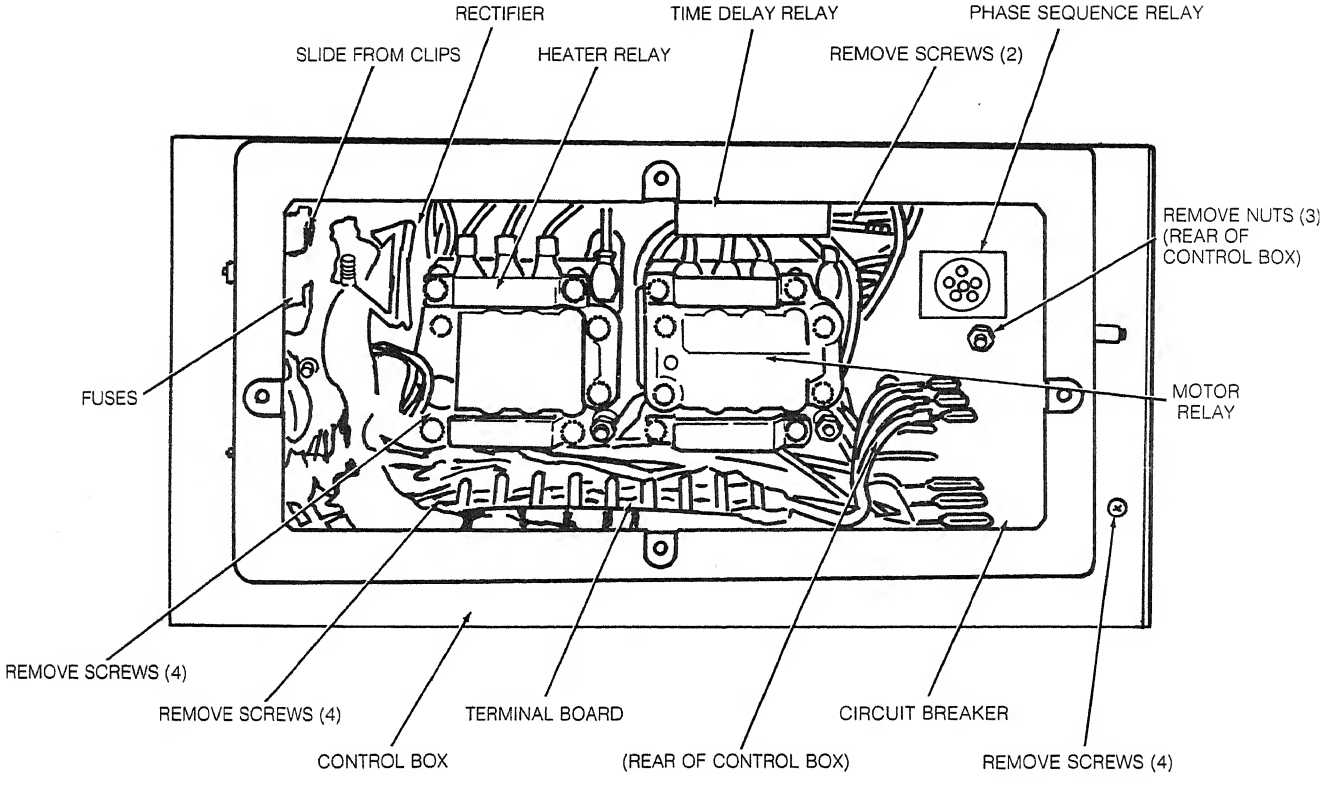



Figure 4-12. Junction Box, Fuses, Rectifier, Time Delay, Terminal Board, Heater Relay, Compressor Motor Relay, Circuit Breaker, Phase Sequence Relay, Removal and Installation

b. **Inspection and Testing.**

(1) Inspect for broken or cracked case and broken or damaged contacts.

(2) Test for continuity through both primary and secondary sides of transformer with multimeter set on OHMS. Refer to wiring diagram, figure 1-3, to establish points of continuity.

c. **Installation.** Refer to figure 4-12 and install transformer.

4-31. Circuit Breaker.

a. **General.** The circuit breaker protects the compressor from continuous overcurrent and short circuits. It is located in the lower right corner of the junction box. Refer to figure 4-12 and push switch lever up to reset.

b. **Removal.** Refer to figure 4-12 and remove the circuit breaker.

c. **Testing.** Refer to figure 4-12 and tag and disconnect the leads. Test the circuit breaker for continuity with a multimeter set on OHMS. Refer to wiring diagram, figure 1-3, to establish points of continuity.

d. **Installation.** Refer to figure 4-12 and install circuit breaker.

4-32. Compressor Motor Relay and Electrical Heater Relay.

a. **General.** Both relays are located in the junction box, figure 4-12. A motor relay starts the compressor motor and a heater relay is connected to the electrical heaters.

b. **Removal.** Refer to figure 4-12 and remove relays.

c. **Inspection and Testing.**

(1) Inspect for pitted or burned contacts.

(2) Test for continuity across coil with a multimeter set on OHMS. Refer to wiring diagram, figure 1-3, to establish points of continuity.

d. **Installation.** Refer to figure 4-12 and install relays.

4-33. Rectifier.

a. **General.** The rectifier changes alternating current to direct current.

b. **Removal.** Refer to figure 4-12 and remove rectifier.

c. **Inspection and Testing.**

(1) Inspect for cracked or broken casing and burned or damaged contacts.

(2) Test for continuity with multimeter set on OHMS. Refer to wiring diagram, figure 1-3, to establish points of continuity.

d. **Installation.** Refer to figure 4-12 and install rectifier.

4-34. Heater Elements.

a. **General.** The electrical resistance heaters are mounted directly behind the evaporator coil. These heaters provide the heat called for by the thermostat to maintain the required temperature of the conditioned air. The heaters provide two ranges of heating and are manually controlled by placing the selector switch in the proper position (LO-HEAT or HI-HEAT) to maintain the required temperature.

b. **Removal.** Refer to figure 4-10 and remove the heater elements.

c. **Inspection and Testing.**

(1) Inspect for broken or damaged elements.

(2) Test for continuity across elements with multimeter set on OHMS. Refer to wiring diagram figure 1-3 to establish points of continuity.

d. **Installation.** Refer to figure 4-10 and install heating elements.

4-35. High Pressure Switch.

a. **General.** The high pressure switch prevents the compressor from operating if the head pressure exceeds 445 psig (fig. 4-13).

b. **Inspection and Testing.**

(1) Inspect for broken or damaged leads and kinked or broken capillary tubing.

(2) Test for continuity across switch with multimeter set on OHMS. Refer to wiring diagram figure 1-3 to establish points of continuity.

4-36. Lo Pressure Switch.

a. **General.** The low pressure switch prevents the compressor from operating if the suction pressure drops below 25 psig (fig. 4-13).

b. **Inspection and Testing.**

(1) Inspect for broken or damaged leads and kinked or broken capillary tubing.

(2) Test for continuity across switch with multimeter set on OHMS. Refer to wiring diagram figure 1-3 to establish points of continuity.

4-37. Fan Speed Pressure Switch.

a. Inspect for broken or damaged contacts (fig. 4-11).

b. Test for continuity with multimeter set on OHMS. Refer to wiring diagram figure 1-3 to establish points of continuity.

4-38. Outside Air Thermostat.

a. **General.** The outside air thermostat is mounted to the rear housing of the air conditioner. It prevents the compressor from starting when the outside temperature is below 50 degrees F. This prevents the unit from being operated at a time when low condensing and suction pressures will hamper system operation.

b. **Removal.** Refer to figure 4-13 and remove the outside air thermostat.

c. **Testing.** Test the thermostat for continuity with a multimeter set on OHMS. Refer to wiring diagram figure 1-3 for points to establish continuity.

d. **Installation.** Refer to figure 4-13 and install outside air thermostat.

4-39. Electric Heater Thermostat.

a. **General.** The electric heater thermostat (fig. 4-10) protects the heater elements from overheating.

b. **Removal.** Refer to figure 4-10 and remove the electrical heater thermostat.

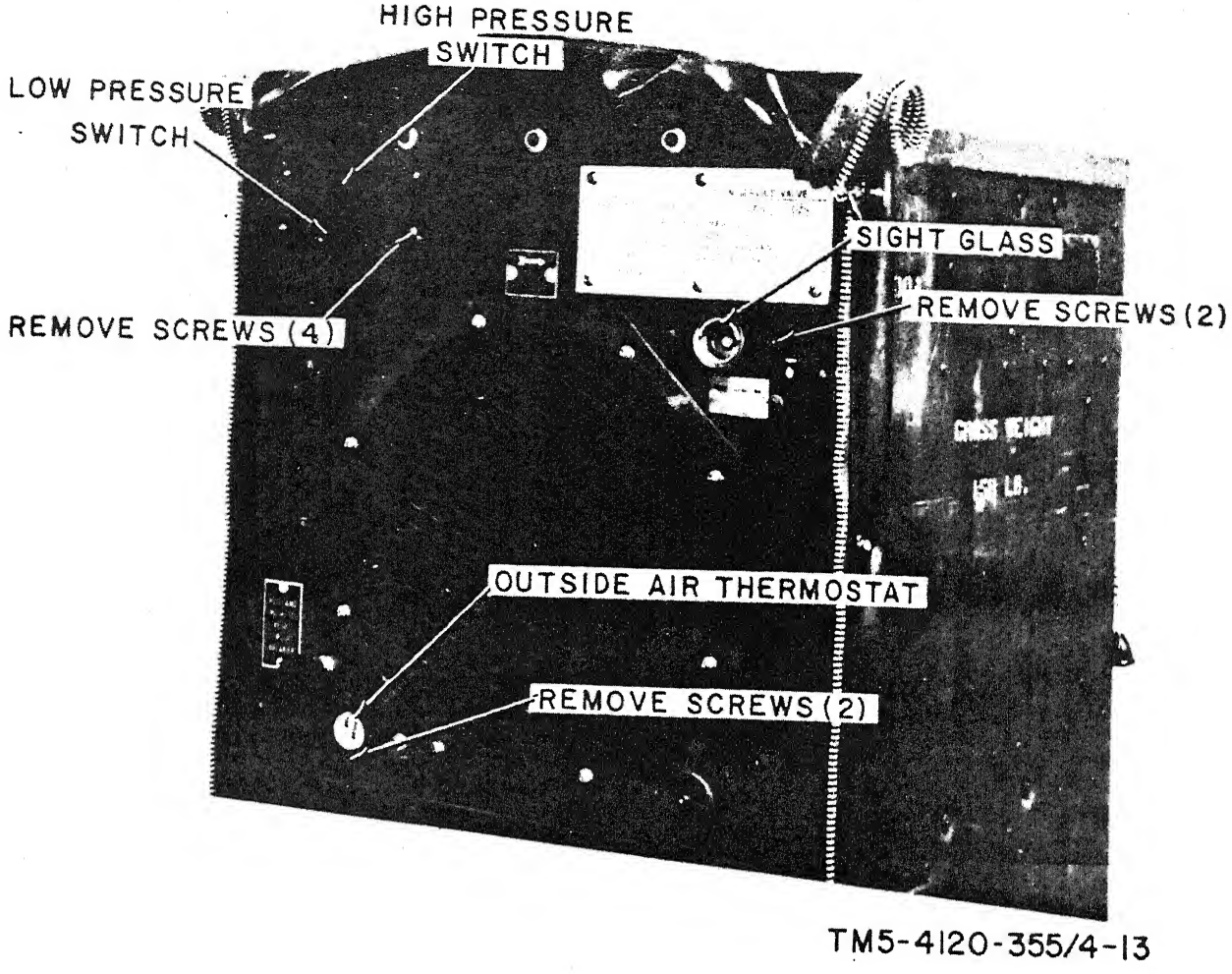



*Figure 4-13. High and Low Pressure Switches, Sight Glass, Outside Air Thermostat, Removal and Installation.*

c. **Testing.** Test for continuity with multimeter set on OHMS. Refer to wiring diagram figure 1-3 to establish points of continuity.

d. **Installation.** Refer to figure 4-10 and install electrical heater thermostat.

4-40. Refrigerant Piping.

a. **Inspection.** Inspect refrigerant piping for kinking, holes, and unsatisfactory welding.

b. **Testing.**

(1) **Halide torch leak detector.** The preferred method of field testing for leaks in the refrigeration system is by using a halide torch of any available tester. Operate the air conditioner, paragraph 2-2, and pass the exploring tube slowly over the sweat fittings, mechanical couplings, and valves. If refrigerant is leaking from the system, the flame of the torch will change from blue to green when the leak is small. If the leak is large, the flame will be a deep blue with a reddish tip or the flame may be entirely extinguished.

(2) **Soap solution method.** Operate the air conditioner, paragraph 2-2, Brush all points of possible leakage with soap solution. Watch for bubbles. Follow a definite sequence so that all joints will be thoroughly tested. Wipe the solution from all joints and mark any spot where leakage occurs.

4-41. Liquid Line Solenoid Valve.

a. **General.** The liquid line solenoid valve is automatically actuated by the thermostat and controls the flow of refrigerant to the evaporator coil.

b. **Inspection.** Inspect for cracked or broken casing and damaged or broken terminals, figure 4-7.

c. **Testing.** Test for continuity across coil with multimeter set on OHMS. Refer to wiring diagram figure 1-3 to establish points of continuity.

4-42. Equalizer Solenoid Valve.

a. **General.** The equalizer solenoid valve is actuated by the on-off switch and serves to equalize system pressure during shutdown.

b. **Inspection.** Inspect for cracked or broken casing and damaged or broken terminals, figure 4-10.

c. **Testing.** Test for continuity across coil with multimeter set on OHMS. Refer to wiring diagram figure 1-3 to establish points of continuity.

4-43. Access Fittings.

a. **General.** The two access fittings (suction line and discharge line) provide access to the refrigerant system, figure 4-7.

b. **Inspection.** Inspect for cracked casing or damaged threads.

4-44. Pressure Relief Valve.

a. **General.** Pressure relief valve (fig. 4-7) is located on a tee just below the filter-drier. The pressure relief valve protects the refrigerant system from excessive pressure.

b. **Inspection.** Inspect for cracked or broken casing.

4-45. Pressure Regulating Valve.

The evaporator pressure regulating valve, fig. 4-10 regulates refrigerant pressure in the evaporator to prevent coil freeze up. The valve is preset to establish a minimum pressure in the evaporator of 58 psig.

4-46. Expansion Valves.

a. **General.** A 1-ton expansion valve controls the rate of flow of liquid refrigerant into the evaporator coil during the cooling cycle of operation (fig. 4-10). The one-half ton expansion valve functions when the unit is in the bypass cycle of operation.

b. **Inspection.**

(1) Check for loose or leaking connections.

(2) Make sure the thermal bulb is securely fastened and is covered with rubber insullation.

4-47. Sight Glass.

a. **General.** The sight glass indicates the refrigerant moisture content. A shortage of refrigerant indicated by flash gas in the sight glass (fig. 4-13).

b. **Inspection.** Inspect for excessive moisture in refrigerant. Excessive moisture is indicated by the changing of the color code from green to yellow.

4-48. Liquid Receiver.

a. **Inspection.** Inspect for cracks or broken casing, figure 4-7.

4-49. Evaporator Coil.

a. **General.** The evaporator coil is mounted on the casing, directly behind the discharge grille. The coil must be removed from the air conditioner for repair or replacement. The mixture of fresh air and recirculated air is passed through the evaporator coil and forced into the conditioned air space by the evaporator fan.

b. **Testing.** Refer to para 4-4 and test with halide torch for refrigerant leaks.

c. **Inspection and Cleaning.**

(1) Inspect coil for bent fins, cracks, or breaks; solder any cracks. Straighten bent fins with coil comb or thin nose pliers.

(2) Clean coil with coil comb or thin nose pliers.

d. **Removal.**

(1) Remove top panel and discharge grille, refer to para 4-15.

(2) Refer to figure 4-10 and remove evaporator coil.

e. **Installation.**

(1) Install the evaporator coil, refer to figure 4-10.

(2) Install the top panel and discharge grille, refer to para 4-15.

4-50. Condenser Coil.

a. **General.** The condenser coil is mounted on the bottom rear of the casing, directly behind the condenser fan. The coil must be removed from the air conditioner for repair or replacement. The coil is made from copper tube and aluminum fin and is of fin-tube configuration.

b. **Testing.** Refer to para 4-40 and test with halide torch for refrigerant leaks.

c. **Inspection and Cleaning.**

(1) Inspect coil for bent fins, cracks, or breaks. Solder any cracks. Straighten bent fins with coil comb or th nose pliers.

(2) Clean coil with low pressure compressed air.

4-51. Drain Tubes.

a. **Removal.**

(1) Remove front panel access panel, para 4-15.

(2) Pull out junction box and control box, refer to paras 4-24 and 4-28.

(3) Unscrew clamps holding drain tubes to unit and remove drain tubes, figure 4-7.

b. **Inspection and Servicing.**

(1) Inspect tubes for obstructions, kinks, or holes.

(2) Install junction box and control box, paras 4-24 and 4-26.

(3) Install front access panel, para 4-15.

4-52. Air Filter.

a. **Removal.** Refer to figure 3-2 and remove air filter.

b. **Installation.** Refer to figure 3-2 and install air filter.

# CHAPTER 5. DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

## Section 1. Repair Parts, Special Tools, and Equipment

5-1. Special Tools and Equipment.

No special tools and equipment are required to perform direct support and general support maintenance on the air conditioner.

5-2. Repair Parts

Repair parts are listed and illustrated in the repair parts and special tools list, TM5-4120-355-24P, covering direct support and general support maintenance parts for the air conditioner.

## Section II. Troubleshooting

5-3. General.

This section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the air conditioner. Each malfunction for an individual component, unit, or system is followed by a list of tests or inspections which will help you to determine corrective action to take. You should perform the tests, inspections, and corrective actions in the order listed.

This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

5-4. Direct Support and General Support Troubleshooting.

Troubleshooting of the air conditioner is given in table 5-1.

Table 5-1. Troubleshooting

| MALFUNCTION<br>TEST OR INSPECTION<br>CORRECTIVE ACTION |
|---|
| 1. COMPRESSOR WILL NOT START<br>Step 1. Make sure the main power cable has been connected.<br>Check main power cable.<br><br>Step 2. The power is not connected to the compressor.<br>Check compressor relay, paragraph 4-32.<br>Check fuses, paragraph 4-29.<br>Check circuit breaker, paragraph 4-31.<br><br>Step 3. The thermostat is set too high.<br>Reset thermostat, figure 4-2A.<br><br>Step 4. Check for loose electrical connection or faulty wiring.<br>Tighten connection or rewire if necessary.<br><br>Step 5. Check if compressor motor is burned out.<br>Replace compressor (para 5-13). |

Step 6. Check if high and low pressure switches are good.
Replace defective pressure switch (paras 4-35 and 4-36).

Step 7. Check if thermostat is operating correctly.
Replace defective thermostat (para 4-27).

2. COMPRESSOR CYCLES INTERMITTENTLY
Step 1. Check for a leaking thermostatic expansion valve.
Replace defective valve (para 4-46).

Step 2. Check setting of low pressure switch.
Reset if setting is too high.

Step 3. Check if there is sufficient refrigerant in system.
Add refrigerant (para 5-9).

Step 4. Check for a leaking thermostatic expansion valve.
Fit leak or replace valve.

Step 5. Check if pressure switch is faulty.
Repair or replace pressure switch (para 4-35 and 4-36).

Step 6. Check for excess refrigerant.
Remove excess refrigerant (para 5-9).

3. HIGH DISCHARGE PRESSURE
Step 1. Check if condenser fan is operating.
Check fan motor and condenser coil and replace if defective (para 4-19).

Step 2. Check for excess refrigerant.
Remove excess refrigerant (para 5-9).

Step 3. Check for air in system (para 5-9).
Evacuate system.

4. LOW DISCHARGE PRESSURE
Step 1. Check if suction line is obstructed.
Clean the line.

5. FLOODING
Step 1. Check if expansion valve is improperly set or defective.
Reset or replace expansion valve (para 4-46).

6. LOW SUCTION PRESSURE
Step 1. Check for sufficient refrigerant.
Add refrigerant (para 5-9).

Step 2. Check for excessive superheat.
Reset expansion valve (para 4-46).

7. COMPRESSOR NOISY
Step 1. Defective compressor.
Replace compressor if play is found in the bearings (para 5-13).
Step 2. Check if bearings are worn.
Replace compressor if play is found in the bearings (para 5-13).

8. CYLINDERS AND CRANKCASE SWEATING
Step 1. Probably due to floodback. Check refrigerant charge and expansion valves.
Adjust refrigerant charge or replace defective expansion valve.

| | |
|---|---|
| 9. | LITTLE OR NO HEATING CAPACITY<br>Step 1. Wiring and wiring harness may be defective.<br>Replace defective wiring (para 5-10).<br><br>Step 2. Check heater elements for continuity.<br>Replace defective element. |

5-5. System Losing Cooling Capacity

If the system is losing cooling capacity, or is in some way not functioning properly, a check of system operating pressure will frequently lead to the cause of malfunction. Install pressure gages on access fittings of suction and discharge lines and expose gages to system pressure. Compare gage readings with normal ranges of systems pressures listed in table 4-2.

Table 4-2. Normal Operating Pressures

| Return air to unit | 90 F/75 F WB | | 80 F/67 F WB |
|---|---|---|---|
| Outdoor ambient | 120 F | 125 F | 95 F |
| GAGE PRESSURE<br>Suction<br>Discharge | 85-95<br>387-395 | 87-97<br>406-416 | 70-80<br>253-263 |

## Section III. General Maintenance

5-6. General

The air conditioner, after it is started, is automatic in operation. The relationship of the automatic components, controls, and instruments, is explained in the operational analysis for maintenance of the air conditioner (para 5-7). A refrigerant piping diagram (fig. 5-1) and practical wiring diagram (fig. 1-3), are included to assist in the maintenance of the electrical components, wiring harness, wire leads, and refrigerant components.

Figure 5-1. Refrigerant flow diagram. (Located in back of manual).

5-7. Analysis of Operation

a. **General.** The type and degree of air conditioning provided by the unit is controlled by a five position selector switch (fig. 4-2A), a thermostat, and a hi-lo fan speed switch.

(1) When the selector switch is in the OFF position, the entire circuit is dead except the crankcase heater.

(2) Placing the selector switch in the HI-HEAT position actuates the fan motor with all six heater elements being under the control of the thermostat. If the air temperature falls below the set point of the thermostat, the control contacts close, energizing the evaporator contactor which supplies power to the heaters through the normally closed contacts of the evaporator heater thermostat.

(3) Moving the selector switch to the LO-HEAT position presents the same control sequence but reduces the heating capacity of the unit by supplying power to three of the heater elements only.

(4) The fan motor starts when the selector switch is placed in the VENTILATE position.

(5) In the COOL position, the fan motor is in operation and the compressor motor contactor is energized through the contacts of the thermostatic switch. The energized contactor supplies power to the compressor through the normally closed contacts of the circuit breaker and the compressor overload protector. After the fan motor and compressor have started, the operation of the refrigerant unit is controlled by the thermostat. Sensing a rise in the air temperature above the set point, the thermostat opens its contacts, deenergizing the liquid line solenoid valve. This positions the system for bypass service.

(6) The HI-LO fan speed switch controls the speed of the fan motor and the fans.

b. **Cooling Cycle of Operation.**

(1) The fan motor and compressor run continuously, whether the thermostat is calling for cooling or not, when the unit is set to operate on the cooling cycle of operation. This feature provides a constant electrical load thus preventing voltage fluctuations within the system.

(2) Bypass cycle of operation. When the conditioned air temperature falls below the thermostat setting, the circuit which controls the solenoid valves is energized causing:

(a) The hot gas bypass line to flow discharge gases through the evaporator pressure regulator bypassing a major part of the compressor refrigerant vapor directly back to the suction side of the compressor.

(b) To prevent frost from forming on the evaporator, a back pressure regulating valve is provided to prevent the suction pressure from decreasing to a pressure of 58 psig which corresponds to a temperature of less than 32 degrees F.

c. **Heating Operation.** Placing the selector switch in the LO-HEAT position actuates half the evaporator heaters mounted in the air conditioned air stream directly behind the evaporator coil. When the selector switch is placed in the HI-HEAT position, the remaining heaters are energized, providing maximum heating capacity.

5-8. General Repair Procedures.

a. If the refrigerant system must be opened for repair or replacement of parts, first discharge the refrigerant from the system. Refer to paragraph 5-9 for instructions.

b. After discharging the system, allow the tubing to warm to the ambient temperature before opening the system; this delay will help prevent the formation of condensation on the inside wall of the tubing. Plug or cap all openings as a part is removed to minimize the entry of dirt and moisture into the system.

c. Use a silver solder on all soldered connections. Silver solder with a 50 percent silver capacity and a melting point of approximately 1300 degrees F is recommended. Continually pass dry nitrogen through the tubing or connections being soldered to prevent formation of harmful copper oxides.

5-9. Servicing the Refrigerant System.

a. **Testing Refrigerant System for Leaks.** Refer to paragraph 4-38, and test refrigerant system for leaks.

b. **Releasing Refrigerant for Service.** Release refrigerant slowly to a well vented atmosphere. Adjust the release so that a vaporized discharge is made to avoid loss of refrigerant oil.

c. **Evacuating the Refrigerant System.**

(1) **General.** Opening the system to the atmosphere will cause entry of air and moisture into the system. After any servicing operation, when the system is opened, the entire system should be evacuated before recharging with refrigerant.

(2) **Evacuation.**

(a) Connect hose assemblies of evacuation gage manifold to discharge valve access fitting and to the suction access fitting of the unit, refer to figure 4-7.

(b) Connect vacuum pump to center hose of gage manifold.

(c) Evacuate pump down to 100 microns.

(d) Break vacuum by admitting refrigerant, subparagraph below.

CAUTION: Do not use the compound gage as an indicator for satisfactory vacuum pressure.

d. **Charging the Refrigerant System.** There are two preferred methods used to charge the refrigerant system.

(1) **Sight glass method.**

(a) Evacuate the system as described in c above.

(b) Remove cap from suction tube charging valve.

(c) Connect hose from refrigeration charging hookup loosely to suction tube charging valve. Open refrigerant drum shutoff valve slightly to purge hose. Tighten connection at charging valve. Open shutoff valve and backseat charging valve.

(d) Refrigerant drum must be in upright position to allow only gaseous refrigerant to enter system.

(e) Start unit.

(f) To speed up charging, set refrigerant drum in warm water. Never use a heating torch for this purpose.

(g) Observe sight glass (fig. 4-13 at the time of charging, and even though the flash gas is apparent, shutoff refrigerant flow and observe sight glass for a period of 10 to 20 minutes. If at the end of this period, the sight glass is not free from flash glass, admit a small amount of charge and observe for the same time period. Repeat this operation until sight glass is clear.

(h) Frontseat charging valves and close refrigerant drum shutoff valve. Stop the unit and disconnect manifold hoses from charging valves, and install caps.

(2) **Weight method.** With this method, you are charging the unit with liquid.

(a) Evacuate the system as described above.

(b) Connect a bottle of refrigerant -22 to discharge high side access fitting, figure 4-7.

(c) Weigh refrigerant bottle.

(d) Invert charging cylinder and open valve on refrigerant bottle and allow refrigerant to flow through system.

(e) Periodically weigh bottle until it is lighter by amount needed in system. This must be the exact amount.

CAUTION: Total amount of charge must be exactly 53 oz.

5-10. Wiring Harness and Wire Leads.

a. **General.** The electrical circuits in the refrigeration unit are completed by individual wire leads or by leads laced or enclosed to form a wiring harness. When testing, repairing, or replacing the individual wires or harnesses, refer to wiring diagram, figure 1-3.

b. **Inspection.** Inspect the wiring insulation for cracks and frayed material. Pay particular attention to the wires passing through holes in the frame or over rough edges. If inspection reveals a broken or cut wire, and the break in the wire is exposed, the wire must be repaired (d below). If the break in a wire is in a harness or inaccessible area, replace wire (e below).

c. **Testing.** Test a wire for continuity by disconnecting each end from the component to which it is connected. Touch the test probes of a multimeter to each end of the wire. If continuity is not indicated, the wire is defective and must be repaired or replaced.

d. **Repair.** Remove the insulation on the wire to expose one-half inch of bare wire at both ends of the break. Twist bare wire together and solder the connection. Cover the repaired break with electrical tape and friction tape. Do not leave any bare wire exposed. If a terminal lug breaks off a wire, replace it, using an exact duplicate terminal lug.

e. **Replacement.** Replace a wire by disconnecting it from the component and remove the wire. Install a new wire and connect it to the component. If a broken wire is part of a wiring harness, disconnect the wire at each end and tape these ends with electrical tape. Install a new wire and attach it to the outside of the wiring harness.

5-11. Tubing and Fittings

The refrigerant piping used on the air conditioning units consists of copper tubing and necessary fittings. Joints of refrigeration pipes and fittings are soldered. Inspect the piping and fittings for cracks and breaks (para 4-40). Replace defective pipes with those of the same length, size, shape, and material. When soldering or unsoldering items such as the thermostatic expansion valves, or solenoid valves, disassemble valves and wrap valves bodies with a damp cloth to protect them from damage by heat.

## Section IV. Removal and Installation

5-12. Compressor

The sole purpose of the compressor is to raise the pressure of refrigerant gas from evaporator pressure to condensing pressure. The function of the compressor is to deliver refrigerant to the condenser at a pressure and temperature at which the condensing process can readily be accomplished. The motor/compressor is a hermetically sealed unit and is not repairable in the field. An inoperative compressor is usually due to a mechanical failure causing the compressor to freeze, control failure, or a motor burnout. If the motor/compressor is mechanically frozen or there has been a motor burnout, the compressor must be removed and replaced. When the motor of a hermetic compressor fails, high temperatures may develop within the compressor causing a breakdown of the oil and refrigerant, resulting in a formation of acid, moisture, and sludge. All these are extremely corrosive and must be flushed from the system. Repeated burnouts will occur if all of the contaminants are not removed.

5-13. Removal and Installation of Compressor.

a. **Removal.**

(1) Remove front access panel (para 4-15) and pullout junction box and control box (para 4-24 and 4-28).

(2) Discharge refrigerant from system (para 5-9b).

(3) Refer to figure 4-7 and remove compressor through front of unit.

b. **Installation.**

(1) Refer to figure 4-7 and install compressor.

(2) Refer to para 5-4 and install condenser coil.

(3) Evacuate and recharge the unit (para 5-9).

(4) Install junction box and control box (para 4-24 and 4-28).

(5) Install front access panel (para 4-15).

## CHAPTER 6. REPAIR OF AIR CONDITIONER

6-1. General.

The compressor is hermetically sealed and cannot be repaired. In case of failure, the compressor must be replaced.

6-2. Compressor.

a. **Removal.** Refer to paragraph 5-13 and remove compressor.

b. **Installation.** Refer to paragraph 5-13 and install compressor.

6-3. Evaporator Coil.

a. Remove top panel and discharge grille (para 4-15).

b. Refer to figure 4-15 and remove evaporator coil.

c. **Repair.** Repair minor leaks or holes by soldering with silver solder (class 4 or 6A, Spec. QQ-S-561) per Spec. MIL-B-7883. If damage is excessive, replace evaporator coil.

d. **Installation.**

(1) Refer to figure 4-15 and install evaporator coil.

(2) Install top panel and discharge grille (para 4-15).

(3) Leak test the entire system (para 4-40).

(4) Evacuate the system (para 5-9).

(5) Recharge the system (para 5-9).

6-4. Condenser Coil.

a. **Removal.**

(1) Evacuate the system (para 5-9).

(2) Remove condenser coil grille (fig. 4-4).

(3) Remove three screws holding filter-drier brackets to shell.

(4) Pull condenser coil, fig. 4-4, from unit and unsolder as required.

b. **Repair.** Repair minor leaks or holes by soldering with silver solder (class 4 or 6A, Spec. QQ-S-561) per Spec. MIL-B-7883. If damage is excessive, replace condenser coil.

c. **Installation.**

(1) Replace condenser coil (fig. 4-4).

(2) Leak test the entire system (para 4-40).

(3) Evacuate and recharge the system (para5-9).

(4) Replace three screws in filter-drier bracket.

(5) Replace condenser coil grille (fig. 4-4).

6-5. High Pressure Switch.

a. **Removal.** Refer to figure 4-13.

(1) Remove four screws holding the high pressure switch.

(2) Remove the switch.

b. **Installation.**

(1) Replace the high pressure switch.

(2) Secure with four screws.

6-6. Low Pressure Switch.

a. **Removal.** Refer to figure 4-13.

(1) Remove four screws holding the low pressure switch.

(2) Remove the switch.

b. **Installation.**

(1) Replace the low pressure switch.

(2) Secure with four screws.

6-7. Fan Speed Pressure Switch.

a. **Removal.** Refer to figure 4-11.

(1) Unscrew the nuts above and below the switch.

(2) Remove the switch.

b. **Installation.**

(1) Put the switch in place.

(2) Secure with nuts above and below the switch.

6-8. Liquid Line Solenoid Valve.

a. **Removal.** Slowly discharge refrigerant from system (para 5-9). Refer to figure 4-7 and remove the liquid line solenoid valve.

b. **Installation.** Refer to figure 4-7 and install the liquid line solenoid valve. Evacuate and recharge refrigeration system (para 5-9).

CAUTION: The solenoid valves must be disassembled before disconnecting the tubing from the valve to avoid heat distortion. Refer to figure 6-1.

CAUTION: Solder tubing to the body of the valve before reassembling the valve to avoid heat distortion. Refer to figure 6-1.

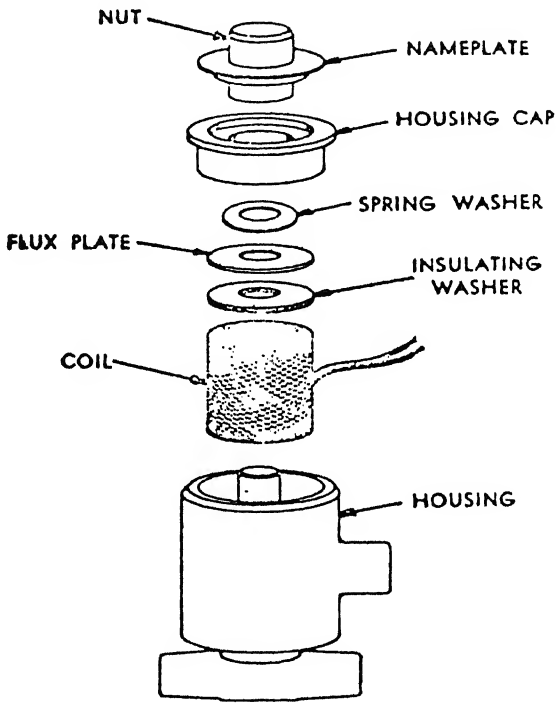



*Figure 6-1. Solenoid Valve, Disassembly and Reassembly.*

6-9. Equalizer Solenoid Valve.

a. **Removal.** Slowly discharge refrigerant from the system (para 5-9). Refer to figure 4-10 and remove the equalizer solenoid valve.

b. **Installation.** Refer to figure 4-10 and install the equalizer solenoid valve. Evacuate and recharge the refrigeration system (para 5-9).

6-10. Pressure Relief Valve.

a. **Removal.** Slowly discharge refrigerant from the system (para 5-9). Refer to figure 4-7 and remove pressure relief valve.

b. **Installation.** Refer to figure 4-7 and install pressure relief valve. Evacuate and recharge the refrigeration system (para 5-9).

6-11. Expansion Valves.

a. **Removal.**

(1) Remove the cover panel (para 4-15).

(2) Discharge refrigerant from the system (para 5-9).

(3) Refer to figure 4-10, remove two bolts and one flare nut on each side of the valve and remove the valve.

b. **Adjustment.**

(1) Remove side cap from expansion valve base.

NOTE: Make sure thermal bulb is securely fastened to suction line and the bulb is covered with rubber insulation.

(2) Turn stem clockwise for higher superheat and counterclockwise for lower superheat. A suction gas superheat of 5 to 10 degrees F out of the evaporator coil is satisfactory. A superheat of 10 to 20 degrees F when measuring the superheat at the thermal bulb is also satisfactory. If the superheat does not reach the required value when adjusted, check for dirt or other restrictions in the liquid line or expansion valve.

c. **Installation.**

(1) Secure the expansion valve with two bolts and secure the flare nut on each side.

(2) Charge the unit (para 5-9).

(3) Replace the cover panel (para 4-15).

6-12. Sight Glass.

a. **Removal.** Slowly discharge the refrigerant charge from the system (para 5-9). Refer to figure 4-13 and remove sight glass.

b. **Installation.** Refer to figure 4-13 and install sight glass. Refer to paragraph 5-9 and recharge system.

6-13. Access Fittings.

a. **Removal.**

(1) Remove front panel (para 4-15).

(2) Slowly discharge the refrigerant charge from the system (para 5-9).

(3) Unscrew valve stem from inside access valve.

b. **Installation.**

(1) Install valve stem into access valve.

(2) Recharge system (para 5-9).

(3) Install front panel (para 4-15).

6-14. Filter Drier.

a. **Removal.** Slowly discharge the refrigerant charge from the system. (para 5-9).

(1) Slowly discharge the refrigerant from the system (para 5-9).

(2) Remove the screw and clamp holding the filter-drier.

(3) Remove the flare nut on top and bottom of the filter-drier and remove unit.

b. **Installation.**

(1) Put the filter-drier in place and tighten flare nut on top and bottom.

(2) Place the clamp around the unit and secure with the screw.

(3) Recharge system (para 5-9).

# APPENDIX A

## REFERENCES

A-1. Administration

| | |
|---|---|
| TM 740-90-1 | Administrative Storage of Equipment. |

A-2. Fire Protection

| | |
|---|---|
| TB 5-4200-200-10 | Hand Portable Fire Extinguisher, Approved for Army Users. |
| TM 5-687 | Repair and Utilities: Fire Protection Equipment and Appliances: Inspection, Operations, and Preventive Maintenance. |

A-3. Demolition

| | |
|---|---|
| TM 750-244-3 | Procedure for Destruction of Equipment. |

A-4. Painting

| | |
|---|---|
| TM 43-0139 | Painting Instructions for Field Use. |

A-5. Maintenance

| | |
|---|---|
| TM 5-764 | Electric Motor and Generator Repair. |
| TM 5-4120-345-ESC | Air Conditioner, Vertical, Compact, 9,000 BTU, 115V, Equipment Servicability Criteria. |
| TM 5-4120-355-24P | Repair Parts and Special Tools List. |
| TM 38-250 | Crate Fabrication. |
| TM 38-750 | The Army Maintenance Management System. |

A-6. Supply Publications

| | |
|---|---|
| C9100-IL | Fuels, Lubricants, Oils, and Waxes. |

# APPENDIX B

# MAINTENANCE ALLOCATION CHART

## Section 1. Introduction

B-1. General.

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions on explanatory notes for a particular maintenance function.

B-2. Maintenance Functions.

a. **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical and/or electrical characteristics with established standards through examination.

b. **Test.** To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. **Service.** Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. **Adjust.** To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. **Align.** To adjust specified variable elements of an item to bring about optimum or desired results.

f. **Calibrate.** To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. **Install.** The act of emplacing, seating, or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. **Replace.** The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. **Repair.** The application of maintenance services (inspect, test, service, adjust, align, calibrate, or replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), and item or system.

j. **Overhaul.** That maintenance effort (services/actions) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. **Rebuild.** Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

B-3. Column Entries Used in the MAC.

a. **Column 1, Group Number.** Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. **Column 2, Component/Assembly.** Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. **Column 3, Maintenance Functions.** Column 3 lists the functions to be performed on the item listed in column 2. (For detailed explanation of these functions, see paragraph B-2).

d. **Column 4, Maintenance Level.** Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform the maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance levels, appropriate work time figures will be shown for each level. The number of man-hours specified by the work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specified tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

C . . . . . .Operator or crew
O . . . . . .Organization maintenance
F . . . . . .Direct support maintenance
H . . . . . .General support maintenance
D . . . . . .Depot maintenance

e. **Column 5, Tools and Equipment.** Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, test, and support equipment to perform the designated function.

f. **Column 6, Remarks.** This column shall contain a letter code in alphabetical order which shall be keyed to the remarks contained in Section IV.

B-4. Column Entries Used in Tool and Test Equipment Requirements.

a. **Column 1, Tool or Test Equipment Reference Code.** The tool and test equipment reference code correlates with a maintenance function on the identified end item or component.

b. **Column 2, Maintenance Level.** The lowest level of maintenance authorized to use the the tool or test equipment.

c. **Column 3, Nomenclature.** Name or identification of the tool or test equipment.

d. **Column 4, National/NATO Stock Number.** The National or NATO stock number of the tool or test equipment.

e. **Column 5, Tool Number.** The manufacturer's part number.

B-5. Explanation of Columns in Section IV.

a. **Reference Code.** The code scheme recorded in column 6, Section II.

b. **Remarks.** This column lists information pertinent to the maintenance function being performed as indicated on the MAC, Section II.

| (1) GROUP NUMBER | (2) COMPONENT/ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE LEVEL C O F H D | (5) TOOLS AND EQUIPMENT | (6) REMARKS |
|---|---|---|---|---|---|
| 01 | AIR CONDITIONING HOUSING & PANELS | | | | |
| | Cover Assembly, Top | Inspect | 0.1 | | |
| | | Service | 0.2 | | |
| | | Replace | 1.0 | | |
| | | Repair | 0.3 | | |
| | Panel, Back | Inspect | 0.1 | | |
| | | Replace | 1.0 | | |
| | Discharge Grille | Inspect | 0.1 | | |
| | | Replace | 0.3 | | |
| | Intake Grille | Inspect | 0.1 | | |
| | | Replace | 1.0 | | |
| | | Repair | 0.3 | | |
| | Panel, Front Access | Inspect | 0.1 | | |
| | | Replace | 1.0 | | |
| | | Repair | 0.3 | | |
| | Air Conditioning Filter | Inspect | 0.2 | | |
| | | Service | 0.3 | | |
| | | Replace | 0.3 | | |
| | Filter, Mist Eliminator | Inspect | 0.3 | | |
| | | Service | 0.3 | | |
| | | Replace | 0.5 | | |
| | Chemical/Biological Cover | Inspect | 0.2 | | |
| | | Replace | 0.3 | | |
| | Condenser Grille | Inspect | 0.2 | | |
| | | Service | 0.2 | | |
| | | Replace | 0.5 | | |
| | Condenser Screen | Inspect | 0.2 | | |
| | | Service | 0.3 | | |
| | | Replace | 0.5 | | |
| | Screen, Fresh Air Inlet | Inspect | 0.2 | | |
| | | Service | 0.3 | | |
| | | Replace | 0.5 | | |
| | Fan Guard | Inspect | 0.2 | | |
| | | Service | 0.3 | | |
| | | Replace | 0.5 | | |

| (1) GROUP NUMBER | (2) COMPONENT/ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE LEVEL C | O | F | H | D | (5) TOOLS AND EQUIPMENT | (6) REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | Damper Door Control | Inspect | | 0.2 | | | | | |
| | | Replace | | | 3.0 | | | | |
| | Casing Assembly | Inspect | | 0.2 | | | | | |
| | | Replace | | | | 5.0 | | | |
| 02 | BLOWER MOTOR & BLOWER FANS | | | | | | | | |
| | Evaporator Fan | Inspect | | 0.2 | | | | | |
| | | Service | | 0.5 | | | | | |
| | | Replace | | | 2.0 | | | | |
| | Condenser Fan | Inspect | | 0.2 | | | | | |
| | | Service | | 0.3 | | | | | |
| | | Replace | | 2.0 | | | | | |
| | Motor Assembly, Blower | Inspect | | 0.5 | | | | | |
| | | Test | | 1.0 | | | | | |
| | | Replace | | | 3.0 | | | | |
| 03 | CONTROL PANEL | | | | | | | | |
| | Receptacle Connector | Inspect | | 0.2 | | | | | |
| | | Test | | 0.4 | | | | | |
| | | Replace | | | 1.0 | | | | |
| | Selector Switch | Test | | 0.5 | | | | | |
| | | Replace | | 1.5 | | | | | |
| | Temperature Control Switch | Test | | 0.5 | | | | | |
| | | Replace | | 1.5 | | | | | |
| 04 | JUNCTION BOX | | | | | | | | |
| | Circuit Breaker | Test | | 0.2 | | | | | |
| | | Replace | | 1.0 | | | | | |
| | Rectifier | Test | | 0.4 | | | | | |
| | | Replace | | 1.0 | | | | | |
| | Contactors, Compressor & Heater | Test | | 0.4 | | | | | |
| | | Replace | | 1.5 | | | | | |
| | Outdoor Thermostat | Test | | 0.2 | | | | | |
| | | Replace | | 1.0 | | | | | |
| | Fuse | Test | | 0.2 | | | | | |
| | | Replace | | 0.3 | | | | | |
| 05 | COMPRESSOR ASSEMBLY | | | | | | | | |
| | Compressor Assembly | Inspect | | | 0.5 | | | | |
| | | Test | | | 0.5 | | | | |
| | | Service | | | 0.5 | | | | |
| | | Replace | | | | 10.0 | | | |

| (1) GROUP NUMBER | (2) COMPONENT/ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE LEVEL C | O | F | H | D | (5) TOOLS AND EQUIPMENT | (6) REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| 06 | EVAPORATOR, HEATER INDICATORS AND PIPING | | | | | | | | |
| | Electric Heater Thermostat | Test | | 0.2 | | | | | |
| | | Replace | | 1.0 | | | | | |
| | Electric Heater Elements | Replace | | | 1.5 | | | | |
| | Back Pressure Regulator Valve | Adjust | | | 1.0 | | | | |
| | | Replace | | | 2.0 | | | | |
| | Evaporator Coil | Inspect | | 0.3 | | | | | |
| | | Service | | 0.3 | | | | | |
| | | Replace | | | 5.0 | | | | |
| | | Repair | | | 5.0 | | | | |
| | Sight Glass | Inspect | | 0.2 | | | | | |
| | | Replace | | | 3.0 | | | | |
| | Thermostatic Expansion Valve | Adjust | | | 1.0 | | | | |
| | | Replace | | | 3.0 | | | | |
| | Suction & Discharge Service Valve | Replace | | | 3.0 | | | | |
| | High Pressure Cutout Switch | Test | | 1.0 | | | | | |
| | | Replace | | | 3.0 | | | | |
| | Hot Gas Bypass Solenoid Valve | Test | | | 1.0 | | | | |
| | | Replace | | | 4.0 | | | | |
| | Tubing & Fittings | Inspect | | 0.5 | | | | | |
| | | Test | | | 0.5 | | | | |
| | | Replace | | | 4.0 | | | | |
| 07 | CONDENSER, DEHYDRATOR AND VALVES | | | | | | | | |
| | Liquid Line Bypass Solenoid Valve | Test | | | 0.5 | | | | |
| | | Replace | | | 4.0 | | | | |
| | Liquid Line Solenoid Valve | Test | | | 0.5 | | | | |
| | | Replace | | | 4.0 | | | | |
| | Dehydrator | Replace | | | 4.0 | | | | |
| | Pressure Relief Valve | Replace | | | 4.0 | | | | |
| | Condenser Coil | Inspect | | 0.2 | | | | | |
| | | Service | | 0.2 | | | | | |
| | | Replace | | | | | 5.0 | | |
| | | Repair | | | | | 2.0 | | |

| (1) GROUP NUMBER | (2) COMPONENT/ASSEMBLY | (3) MAINTENANCE FUNCTION | (4) MAINTENANCE LEVEL C O F H D | (5) TOOLS AND EQUIPMENT | (6) REMARKS |
|---|---|---|---|---|---|
| 08 | ACCESSORY ITEMS | | | | |
| | Block Off Panel | Install | 1.0 | | |
| | | Replace | 1.0 | | |
| | Sound Attenuator & Paulin | Inspect | 0.2 | | |
| | | Install | 0.5 | | |
| | | Replace | 1.0 | | |

## INDEX

## INDEX

**By Order of the Secretary of the Army:**

**E. C. MEYER**
***General, United States Army***
***Chief of Staff***

**Official:**

**J. C. PENNINGTON**
***Major General, United States Army***
***The Adjutant General***

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25C, Operator Maintenance Requirements for Environmental Equipment Air Conditioners, 6000 BTU.

☆U.S. GOVERNMENT PRINTING OFFICE: 1990 - 261-872/20302

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

# SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)
PFC JOHN DOE
COA, 3d ENGINEER BN
FT. LEONARD WOOD MO 63108

DATE

| PUBLICATION NUMBER | DATE | TITLE |
|---|---|---|
| TM5-4120-455-14 | 30 Jul 79 | Air Conditioner, Vertical Compact, 6,000 BTU |

BE EXACT. . .PIN-POINT WHERE IT IS

| PAGE NO. | PARAGRAPH | FIGURE NO. | TABLE NO. |
|---|---|---|---|
| 6 | 2-1 a | | |
| 81 | | 4-3 | |
| 125 | line 20 | | |

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.

Callout 16 on figure 4-3 is pointing at a bolt. In the key to fig. 4-3 item 16 is called a shim. Please correct one or the other.

I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gaskit but it doesn't fit. Supply says I got what I ordered so the NSN is wrong. Please give me a good NSN.

SAMPLE

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
JOHN DOE, PFC (268) 317-7111

SIGN HERE:
John Doe

DA FORM 1 AUG 74 2028-2 (TEST)

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DRSTS-M Overprint 1, 1 Nov 78

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|---|---|---|---|
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|---|---|---|---|
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RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

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TEAR ALONG DOTTED LINE

by

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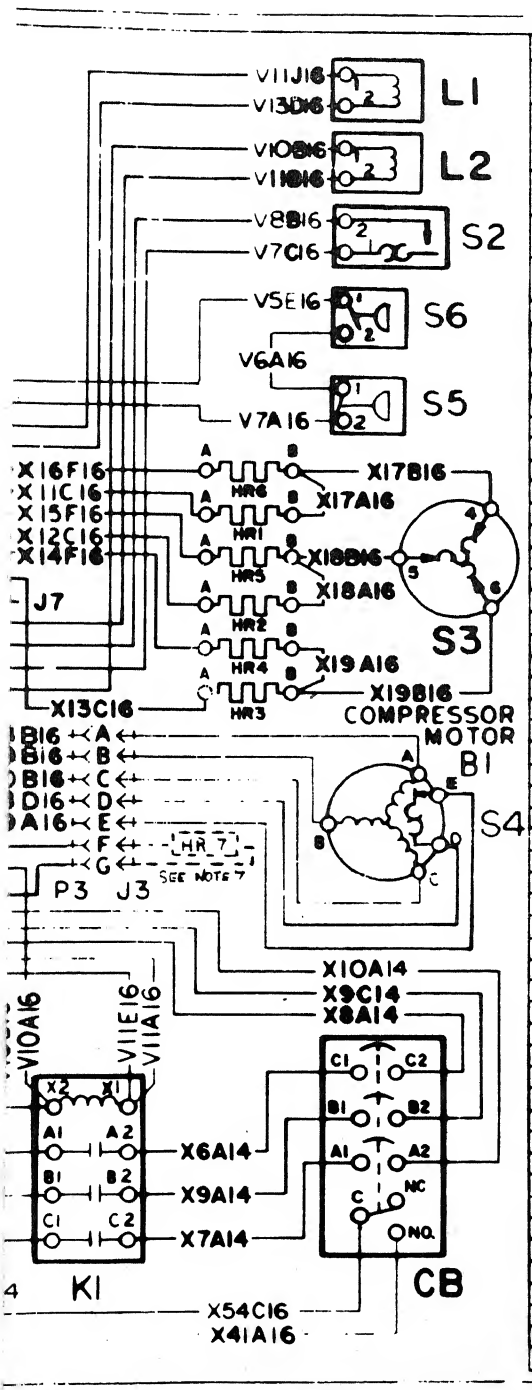
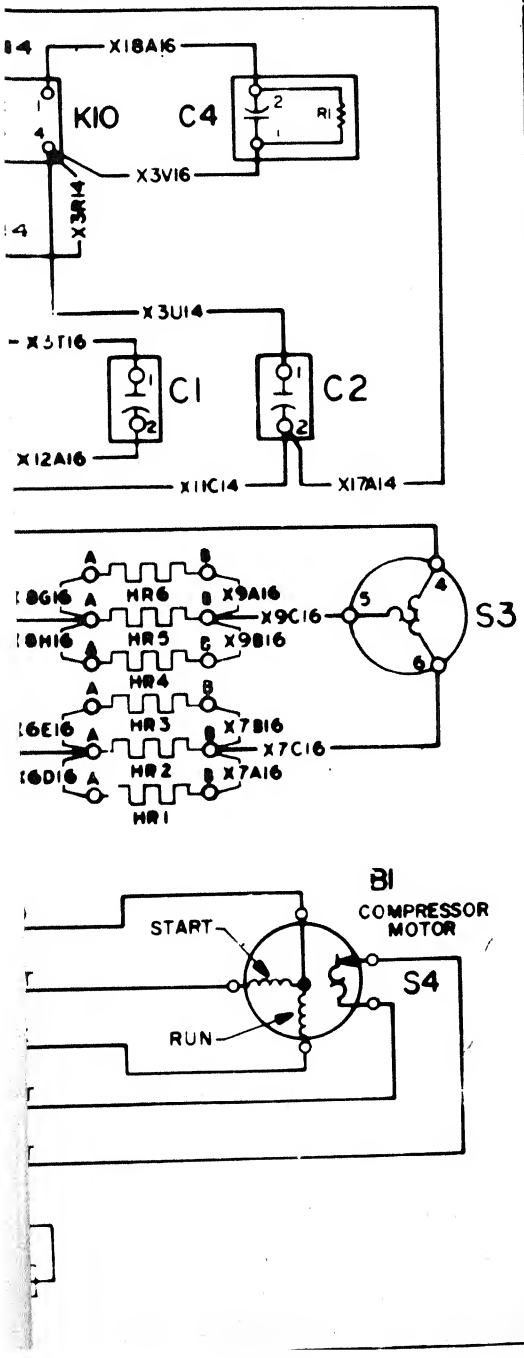



| | CONTACT NO. | SWITCH POSITION 1 HI HEAT | 2 LO HEAT | 3 OFF | 4 VENT | 5 COOL |
|---|---|---|---|---|---|---|
| S/W1 | 2 & A | CLOSED | CLOSED | OPEN | OPEN | OPEN |
| | 2 & B | OPEN | OPEN | OPEN | OPEN | CLOSED |
| | 1 & D | OPEN | OPEN | OPEN | OPEN | CLOSED |
| S/W2 | 2 & B | CLOSED | CLOSED | OPEN | CLOSED | CLOSED |
| | 1 & C | CLOSED | CLOSED | OPEN | CLOSED | CLOSED |
| S/W3 | 2 & A | CLOSED | OPEN | OPEN | OPEN | OPEN |
| | 1 & C | CLOSED | CLOSED | OPEN | CLOSED | CLOSED |
| S/W4 | 2 & A | CLOSED | OPEN | OPEN | OPEN | OPEN |
| | 1 & C | CLOSED | OPEN | OPEN | OPEN | OPEN |

LEGEND

| SYMBOL | PART NO. | DESCRIPTION |
|---|---|---|
| S8 | 13216E7690 | SWITCH, PRESSURE CONTROL |
| J1 | MS3100R-20-4P | CONNECTOR RECEPTACLE |
| P1 | MS3106R-20-4S | CONNECTOR PLUG |
| J2 | MS3102R-20-27P | CONNECTOR RECEPTACLE |
| P2 | MS3106R-20-27S | CONNECTOR PLUG |
| J3 | MS3102R-16S-1P | CONNECTOR RECEPTACLE |
| P3 | MS3106R-16S-1S | CONNECTOR PLUG |
| J4 | MS3102R-28-12S | CONNECTOR RECEPTACLE |
| P4 | MS3106R-28-12P | CONNECTOR PLUG |
| E1 | MS35207-267 | GROUND, CONTROL PANEL |
| E2 | MS35207-267 | GROUND, JUNCTION BOX |
| E3 | MS90726-5 | GROUND, FRAME |
| L1 | 13214E3524 | VALVE, SOLENOID, LIQUID LINE |
| J7 | MS3100R-16S-1PW | CONNECTOR RECEPTACLE |
| P7 | MS3106R-16S-1SW | CONNECTOR PLUG |
| J8 | 13211E8399C2S-11P | CONNECTOR RECEPTACLE |
| P8 | MS3100R-28-11S | CONNECTOR RECEPTACLE |
| C1 | CR65AY1DCM | CAPACITOR, FILTER, MIL-C-11015 2 |
| K1 | MS24192-D1 | RELAY, COMPRESSOR |
| J10 | MS3102R-32-6P | CONNECTOR RECEPTACLE |
| P10 | MS3106R-32-6S | CONNECTOR PLUG |
| B1 | 13214E3538-2 | MOTOR, COMPRESSOR |
| B2 | 13214E3728-2 | MOTOR, ALTERNATING CURRENT, FAN |
| CB | 13216E6205-7 | CIRCUIT BREAKER |
| CR | 13214E3652 | RECTIFIER, SEMICONDUCTOR DEVICE |
| F1, F2 | MIL-F-15160 | FUSE (TYPE FOSA250V2A) |
| F3 | 13211E3785 | FUSE |
| K2 | MS24192-D1 | RELAY, HEATER |
| L2 | 13214E3524 | VALVE, SOLENOID, PRESSURE EQUALIZER |
| K7, K8 | 13215E9921 | RELAY, FAN |
| CR1 | 13216E7689 | DIODE, SURGE PROTECTOR |
| K5 | 13214E3487-1 | RELAY, PHASE SEQUENCE |
| K6 | 13216E6182-3 | RELAY, TIME DELAY |
| S | 13211E8298 | SWITCH, ROTARY |
| S1 | 13211E8301-1 | THERMOSTAT, TEMPERATURE CONTROL |
| S2 | 13211E8180 | THERMOSTAT, AMBIENT AIR TEMPERATURE |
| S3 | 13211E8265 | THERMOSTAT, HEATER |
| S4 | P O 13214E3528-2 | THERMOSTAT, COMPRESSOR |
| S5 | 13211E8404 | SWITCH, HIGH PRESSURE CUTOUT |
| S6 | 13214E3794 | SWITCH, LOW PRESSURE CUTOUT |
| S7 | 4324523-22 | SWITCH, TOGGLE, FAN, HI-LO SPEED |
| T | 13214E3818-1 | TRANSFORMER |
| TB1 | MIL-T-55164/3B | TERMINAL BOARD |
| TB2 | 13214E3804 | TERMINAL BOARD |
| XF1 | 13211E3784 | FUSEHOLDER, POWER INPUT, AC |
| XF2 | 13214E3811 | FUSEHOLDER, CONTROL VOLTAGE, DC |
| HR1-6 | 13214E3561 | HEATING ELEMENT |

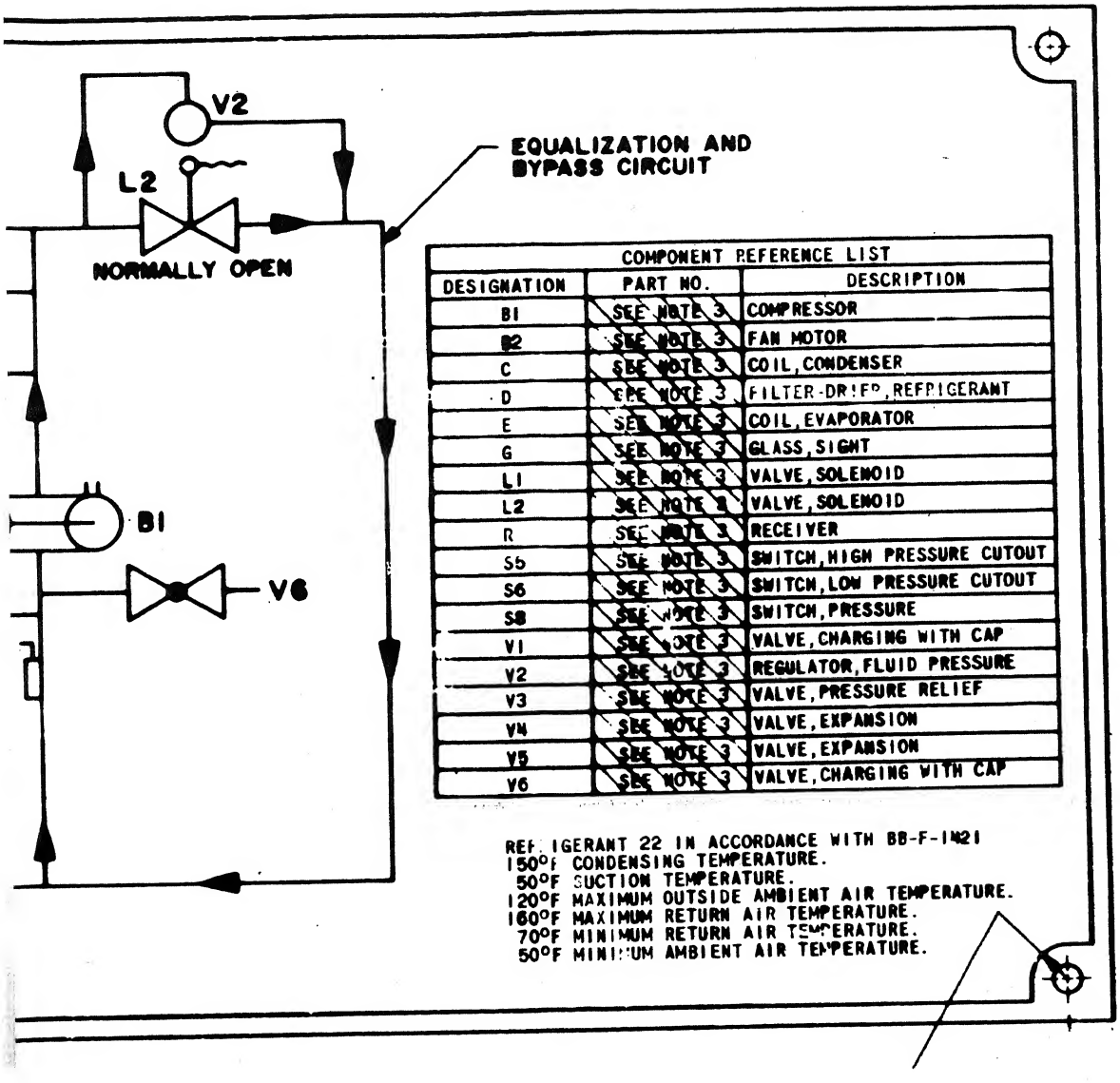



## SWITCH POSITION

| | CONTACT NO. | 1 HI HEAT | 2 LO HEAT | 3 OFF | 4 VENT | 5 COOL |
|---|---|---|---|---|---|---|
| S/W1 | 2 & A | CLOSED | CLOSED | OPEN | OPEN | OPEN |
| | 2 & B | OPEN | OPEN | OPEN | OPEN | CLOSED |
| | 1 & D | OPEN | OPEN | OPEN | OPEN | CLOSED |
| S/W2 | 2 & B | CLOSED | CLOSED | OPEN | CLOSED | CLOSED |
| S/W3 | 2 & A | CLOSED | OPEN | OPEN | OPEN | OPEN |

## LEGEND

| SYMBOL | PART NO. | DESCRIPTION |
|---|---|---|
| B1 | 13214E3538-1 | MOTOR COMPRESSOR |
| B2 | 13214E3728 | MOTOR ALTERNATING CURRENT FAN |
| C1 | 13214E3529 1 | CAPACITOR FAN MOTOR |
| C2 | 13214E3529 2 | CAPACITOR COMPRESSOR MOTOR RUN |
| C3 | 13219E9891 | CAPACITOR ASSEMBLY |
| C4 | 13220E8228 2 | CAPACITOR COMPRESSOR MOTOR START |
| CB | 13216E6206 4 | CIRCUIT BREAKER |
| CR | 13214E3652 | RECTIFIER SEMICONDUCTOR DEVICE |
| E1 | MS 35207 267 | GROUND, CONTROL PANEL |
| E2 | MS 35207 267 | GROUND, JUNCTION BOX |
| E3 | MS 90726 | GROUND, FRAME |
| E4 | MS 35207 267 | GROUND, EXTERNAL |
| F1 | MIL F 15160 | FUSE (TYPE F09A250V3A) |
| F2 | 13211E3735 | FUSE |
| HR1 6 | 1321 -E3561 | HEATING ELEMENT |
| HR7 | P/O 13214E3538 1 | CRANKCASE HEATER COMPRESSOR |
| J1 | MS 3100R 20 4PX | CONNECTOR RECEPTACLE |
| J2 | MS 3102R 14S 6P | CONNECTOR RECEPTACLE |
| J3 | MS 3102R 16S 1P | CONNECTOR RECEPTACLE |
| J4 | MS 3102R 32 7P | CONNECTOR RECEPTACLE |
| J7 | MS 3100R 16 10P | CONNECTOR RECEPTACLE |
| J8 | 13211E8399C 28-17P | CONNECTOR RECEPTACLE |
| J10 | MS 3102R-28 9S | CONNECTOR RECEPTACLE |
| K1 | MS 24192-21 | RELAY, COMPRESSOR |
| K2 | MS 24192 21 | RELAY 25 AMP, 3 PST N.O. |
| K6 | 13216E6182 3 | RELAY, TIME DELAY COMPRESSOR |
| K7 | 13215E9921 | RELAY, FAN |
| K9 | 13216E6182-2 | RELAY, TIME DELAY, FAN MOTOR |
| K10 | 13216E6240 | RELAY, ARMATURE |
| L1 | 13214E3524 | VALVE, SOLENOID, LIQUID LINE |
| L2 | 13214E3524 - | VALVE, SOLENOID, PRESSURE EQUALIZER |
| P1 | MS 3106R 20 -SX | CONNECTOR PLUG |
| P2 | MS 3106R 14S 2S | CONNECTOR PLUG |
| P3 | MS 3106R-16S-1S | CONNECTOR PLUG |
| P4 | MS 3106R 32 7S | CONNECTOR PLUG |
| P7 | MS 3106R 14S 10S | CONNECTOR PLUG |
| P8 | MS 3100R 28 17S | CONNECTOR RECEPTACLE |
| P10 | MS 3106R 28 9P | CONNECTOR PLUG |
| R1 | P/O 13220E8228 2 | RESISTOR, CAPACITOR BLEEDER |
| S | 13211E8298 | SWITCH, ROTARY |
| S1 | 13211E3301 1 | THERMOSTAT, TEMPERATURE CONTROL |
| S2 | 13211E3180 | THERMOSTAT AMBIENT AIR TEMPERATURE |
| S3 | 13211E8265 | THERMOSTAT HEATER |
| S4 | P/O 13214E3538 1 | THERMOSTAT COMPRESSOR |
| S5 | 13211E3404 | SWITCH, HIGH PRESSURE CUTOUT |
| S6 | 13214E3794 | SWITCH, LOW PRESSURE CUTOUT |
| S7 | MS 24523 22 | SWITCH TOGGLE FAN, HI-LO SPEED |
| S8 | 13216E3590 2 | SWITCH, PRESSURE CONTROL |
| T1 | 13214E3818 2 | TRANSFORMER |
| TB1 | MIL F 55164/5 | TERMINAL BOARD |
| TB2 | 1321-E3804 | TERMINAL BOARD |
| XF1 | 13211E3791 | FUSEHOLDER, POWER INPUT, AC |
| XF2 | 1321 -E3811 | FUSEHOLDER, CONTROL VOLTAGE, DC |




| COMPONENT REFERENCE LIST | | |
|---|---|---|
| DESIGNATION | PART NO. | DESCRIPTION |
| B1 | SEE NOTE 3 | COMPRESSOR |
| B2 | SEE NOTE 3 | FAN MOTOR |
| C | SEE NOTE 3 | COIL, CONDENSER |
| D | SEE NOTE 3 | FILTER-DRIER, REFRIGERANT |
| E | SEE NOTE 3 | COIL, EVAPORATOR |
| G | SEE NOTE 3 | GLASS, SIGHT |
| L1 | SEE NOTE 3 | VALVE, SOLENOID |
| L2 | SEE NOTE 3 | VALVE, SOLENOID |
| R | SEE NOTE 3 | RECEIVER |
| S5 | SEE NOTE 3 | SWITCH, HIGH PRESSURE CUTOUT |
| S6 | SEE NOTE 3 | SWITCH, LOW PRESSURE CUTOUT |
| S8 | SEE NOTE 3 | SWITCH, PRESSURE |
| V1 | SEE NOTE 3 | VALVE, CHARGING WITH CAP |
| V2 | SEE NOTE 3 | REGULATOR, FLUID PRESSURE |
| V3 | SEE NOTE 3 | VALVE, PRESSURE RELIEF |
| V4 | SEE NOTE 3 | VALVE, EXPANSION |
| V5 | SEE NOTE 3 | VALVE, EXPANSION |
| V6 | SEE NOTE 3 | VALVE, CHARGING WITH CAP |

REFRIGERANT 22 IN ACCORDANCE WITH BB-F-1421
150°F CONDENSING TEMPERATURE.
50°F SUCTION TEMPERATURE.
120°F MAXIMUM OUTSIDE AMBIENT AIR TEMPERATURE.
160°F MAXIMUM RETURN AIR TEMPERATURE.
70°F MINIMUM RETURN AIR TEMPERATURE.
50°F MINIMUM AMBIENT AIR TEMPERATURE.

# The Metric System and Equivalents

### *Linear Measure*

1 centimeter = 10 millimeters = . 39 inch
1 decimenter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

### *Weights*

1 centigram = 10 milligrams = . 15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigrams = . 035 ounce
1 dekagram = 10 grams = . 35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

### *Liquid Measure*

1 centiliter = 10 milliliters = . 34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 38.82 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

### *Square Measure*

1 sq. centimeter = 100 sq. millimeters = . 155 sq. inch
1 sq. decimenter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = . 386 sq. mile

### *Cubic Measure*

1 cu. centimeter = 1000 cu. millimeters = . 06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu meter = 1000 cu. decimeters = 35.31 cu. feet

# Approximate Conversion Factors

| *To change* | *To* | *Multiply by* |
|---|---|---|
| inches | centimeters | 2.540 |
| feet | meters | .305 |
| yards | meters | .914 |
| miles | kilometers | 1.609 |
| square inches | square centimeters | 6.451 |
| square feet | square meters | .093 |
| square yards | square meters | .836 |
| square miles | square kilometers | 2.590 |
| acres | square hectometers | .405 |
| cubic feet | cubic meters | .028 |
| cubic yards | cubic meters | .765 |
| fluid ounces | milliliters | 29,573 |
| pints | liters | .473 |
| quarts | liters | .946 |
| gallons | liters | 3.785 |
| ounces | grams | 28.349 |
| pounds | kilograms | .454 |
| short tons | metric tons | .907 |
| pound-feet | newton-meters | 1.365 |
| pound-inches | newton-meters | .11375 |

| *To change* | *To* | *Multiply l* |
|---|---|---|
| ounce-inches | newton-meters | .00706 |
| centimeters | inches | .39 |
| meters | feet | 3.28 |
| meters | yards | 1.09 |
| kilometers | miles | .62 |
| square centimeters | square inches | .15 |
| square meters | square feet | 10.76 |
| square meters | square yards | 1.19 |
| square kilometers | square miles | .38 |
| square hectometers | acres | 2.47 |
| cubic meters | cubic feet | 35.31 |
| cubic meters | cubic yards | 1.30 |
| milliliters | fluid ounces | .034 |
| liters | pints | 2.113 |
| liters | quarts | 1.057 |
| liters | gallons | .264 |
| grams | ounces | .035 |
| kilograms | pounds | 2.205 |
| metric tons | short tons | 1.102 |

# Temperature (Exact)

| | | | | |
|---|---|---|---|---|
| °F | Fahrenheit temperature | 5/9 (after subtracting 32) | Celsius temperature | °C |